

BULLETIN OF THE
VANDERBILT MARINE MUSEUM

VOLUME VI

Scientific Results of the World Cruise of
the Yacht "Alva", 1931,
William K. Vanderbilt,
Commanding.

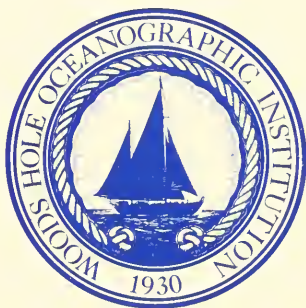
CRUSTACEA: ANOMURA, MACRURA,
EUPHAUSIACEA, ISOPODA, AMPHIPODA,
AND
ECHINODERMATA:
ASTEROIDEA AND ECHINOIDEA

By LEE BOONE

Gift of

Christina H. Hamm
The Vanderbilt Museum

November 1987



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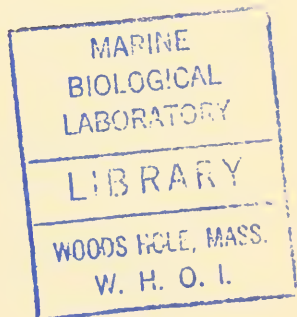
1937
Scientific Results of the World Cruise of the Yacht
"Alva," 1931, William K. Vanderbilt, Commanding

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ASTEROIDEA AND ECHINOIDEA

By LEE BOONE

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IN MEMORY OF THE
"EAGLE"

THE SEA

Dark-heaving, boundless, endless and sublime
The image of eternity—the throne of the Invisible; even from out thy slime
The monsters of the deep are made; each zone
Obeys thee; thou goest forth dread, fathomless, alone.

—*Byron.*

ANNOUNCEMENT

1

The Vanderbilt Marine Museum is the privately owned depository of the marine collections of William K. Vanderbilt, Esquire, and is located on his country estate, "Eagle's Nest," Huntington, Long Island, New York. It contains extensive collections of natural history and ethnological specimens, all of which were personally collected by Mr. Vanderbilt during the past thirty-odd years.

The scientific publications of the museum consist of a series of Bulletins, designed to disseminate results of research based on the marine zoological collections, every specimen of which was personally collected by Mr. Vanderbilt during a series of cruises in his yachts, "Eagle," "Ara" and "Alva." Volume I of the Bulletin series consists of reports on the fishes collected during these cruises, by Dr. N. A. Borodin. Volume II consists of a report on the Stomatopod and Brachyuran Crustacea of the cruises of the yachts "Eagle" and "Ara," 1921-1928, by Lee Boone. Volume III consists of a report of the Crustacea: Anomura, Macrura, Schizopoda, Isopoda, Amphipoda, Mysidacea, Cirripedia and Copepoda of the same cruises of the "Eagle" and "Ara," also by Lee Boone. Volume IV consists of a report of the Echinodermata, Coelenterata and Mollusca of the cruises of the yachts "Eagle" and "Ara," 1921-1928, by Lee Boone. Volume V consists of a report on the Crustacea: Stomatopoda and Brachyura of the World Cruise of the yacht "Alva," 1931, by Lee Boone. Volume VI, the present report, treats of the Crustacea: Anomura, Macrura, Euphausiacea, Isopoda, and Amphipoda, and of Echinodermata: Asteroidea and Echinoidea of the World Cruise of the yacht "Alva," 1931, by Lee Boone.

These Bulletins are available for distribution to scientific establishments by purchase, or by exchange for equivalent research reports in related subjects. They may be obtained by addressing Mr. Vanderbilt at the Vanderbilt Marine Museum, Huntington, Long Island, New York.

Other Bulletins will be issued from time to time, as made desirable by results of research on the Vanderbilt collections. Another volume is now in preparation.

THE CRUSTACEA: ANOMURA, MACRURA,
EUPHAUSIACEA, ISOPODA, AMPHIPODA AND
ECHINODERMATA: ASTEROIDEA AND ECHINOIDEA
OF THE "ALVA" WORLD CRUISE, 1931,
WILLIAM K. VANDERBILT, COMMANDING

by
LEE BOONE

INTRODUCTION

1

The present Bulletin, sixth in the scientific series of the Vanderbilt Marine Museum, contains the second report on the Crustacea and first report on the Echinodermata secured by Mr. William K. Vanderbilt during a world cruise in his yacht "Alva" in 1931. The narrative of this voyage, "West Made East With the Loss of a Day," has been entertainingly told by Mr. Vanderbilt in a beautifully illustrated volume with a map of the voyage. The preceding Bulletin contains a report of the Indo-Pacific Crustacea Stomatopoda and Brachyura secured by the "Alva." The present volume consists of two separate reports, the first of which treats of the Crustacea Anomura, Macrura, Euphausiacea, Isopoda, and Amphipoda. This material is from the Indo-Pacific region, except a few hundred specimens from deep-sea dredgings in the eastern Atlantic Ocean, off the Canary Islands.

The bathymetric occurrence of the species secured ranges from terrestrial, freshwater and littoral to true deep-sea forms, from depths ranging from 140 to 400 fathoms. The collection is extensive and contains many representatives of the littoral fauna from the fascinating coral reefs and tidal zone of the Marquesas Islands, Society Islands, Fiji Archipelago, Samoan Islands, New Caledonia, Bali, Banka Island and the Durian Straits, Dutch East Indies, Penang and Singapore. Some terrestrial Crustacea from the Society Islands were obtained. Members of the freshwater fauna of the Society Islands, Fiji Islands and Malay Straits were secured. The deep-sea dredgings represented are from stations in the Dutch East Indies; off the Marquesas Islands, and off

the New Hebrides, in the Pacific, and off the Canary Islands, in the Atlantic Ocean.

The annotated discussion of the species is presented with reference to their systematic classification. A list of the species obtained in each archipelago, or other major locality is also given.

Published records evidence a deplorable paucity of Indo-Pacific Crustacea in the collections of American museums. Prof. Dana's great collection was mostly destroyed, or badly injured by drying and varnishing. Mr. Stimpson's invaluable types and collections, given the Smithsonian Institute, are vanished or inaccessible. The great majority of the "Alva" Crustacea are not represented in any other American museum. In addition to a number of very rare specimens, hitherto known only from one or two specimens in Asiatic or European museums, the "Alva" collection has one new genus and eleven new species. The new genus and species, *Vanderbiltia rosamondae*, from Tahiti, is remarkably interesting, possessing most unusual specialization in adaptation to its life in the coral crevices. Three new species of the family *Apheidae* are described. *Athanas gracilis* Boone, from Raiatea Island, adds another species to this small genus of snapping shrimps with well developed eyes. *Alpheus exptorator* Boone from Flores Strait, Dutch East Indies, depth 140 fathoms, is closely related to the rare *Alpheus makrosceles* Alcock and Anderson, a nearly blind deep-sea species from the Bay of Bengal, but differs in having well developed ocular lobes. *Alpheus braschi* Boone, from Samoa, belongs to the *Macrochirus* group of reef-dwelling *Alpheus*. Two more new species of *Alpheus* are included in the collection from Bali, but unfortunately are imperfect specimens. *Leptochela pellucida* Boone, from the Durian Straits, adds another member to this primitive genus. *Coralliocaris tahitoei* Boone, from Raiatea Island, is the seventh Indo-Pacific member of this unique coral reef-dwelling genus; four species of which are included in the "Alva" collection. *Pontophilus vanderbilti* Boone, from Durian Straits, is one of the most exquisitely sculptured species of this genus of beautiful *Crangonids*, some species of which spend their lives in the sunlit tropic shallows, their fragile translucent bodies as evanescent as the shadow of a ripple, while others have their being in the icy darkness over two thousand fathoms down. *Euphausia alvae* Boone, from Flores Straits, and *E. consuelae* Boone, from off the New Hebrides, are each new deep-sea species, founded upon an extensive type series. *Stylocheiron longicorne* G. O. Sars

is here represented by adults from off the Canary Islands, also from off Marquesas Islands. *Brachyscelus stebbingi* Boone is a weird-looking deep-sea Amphipod with enormous eyes which are less than half so large as those of other members of the genus. It comes from off the Canary Islands. *Galathea balica* Boone, the only new anomuran in the collection, is a delicately sculptured inhabitant of the coral crevices of Bali.

The Echinodermata are discussed under Part II.

ACKNOWLEDGMENTS

I am especially grateful to Mr. Vanderbilt for his unstinted generosity which has graciously enabled me to prosecute this investigation. I am also indebted to Dr. Herbert Putnam, Librarian of Congress, and his assistants, Mr. Martin Roberts and Mr. F. E. Brasch, for granting me special research privileges in this institution. The photographs of the Echinodermata were made by Mr. Ernest L. Crandall, of Washington, D. C. The line drawings for plates 1 to 6, inclusive, also for plates 8 to 13, inclusive, also plates 22, 24 and 38 were made under my direction by Mrs. Elizabeth M. Fulda, of New York City; the remaining plates were similarly drawn by two other assistants.

As in the preparation of Volume V of this Bulletin series, I am inexpressibly indebted to my colleagues in the Asiatic and European museums and universities, and to Dr. Austin H. Clark of the United States National Museum, for many helpful courtesies.

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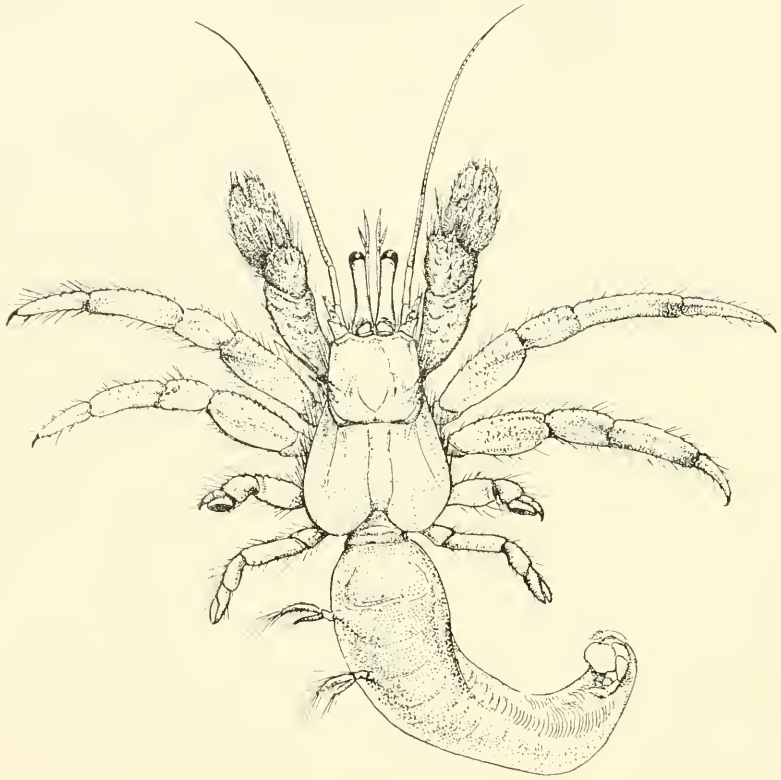
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Clibanarius corallinus (H. M. Edwards), $\times 2$.

SYSTEMATIC DISCUSSION

PART I

ANOMURA

Family: PAGURIDAE

Subfamily: Pagurinae Ortmann

Genus: CLIBANARIUS Dana

Clibanarius corallinus (H. M. Edwards)

1

Plate 1

TYPE: Dr. Milne Edwards' type was collected in New Guinea by M. Quoy and Gaimard and is deposited in the Paris Museum.

DISTRIBUTION: Andaman Islands, Nicobar Islands (Alcock, Heller); Liu Kiu Islands (Stimpson); Kota Bharu, Kelantan, Malay Archipelago (Lanchester); Pulo Edam Island, Nordwacher Island, Borneo (de Man); New Guinea (Edwards); Murray Island, Torres Straits (McCulloch); Falcon Island, Palm Islands, Queensland (Boone); Solomon Islands (McCulloch); Funafuti, Ellice Islands (Borradaile, McCulloch); Fiji Islands (Dana); Samoa (Boone); Howland Islands (Ortmann); Wake Island (Dana); Fanning Island (Edmondson); Tahiti, Society Islands (Heller, Dana, Ortmann); Bora Bora, Society Islands (Boone); Puamu-Apataki, Hao Island, Paumotu Archipelago (Nobili).

MATERIAL EXAMINED: Thirty-seven specimens, two of which are imperfect, collected on the reefs of Falcon Island, Palm Islands, Queensland, Australia, October 7, 1931. Two small specimens, from Apia, Samoa, September 5, 1931. One specimen from Bora Bora Island, Society Islands, August 24, 1921.

COLOUR: The preserved specimens have the carapace whitish, spotted with red; the legs are red, except the dactyli, which are white, except for the black claw-tips. The spines of the chelipeds are white with black tips; the setae are golden.

TECHNICAL DESCRIPTION: Species small. Carapace unusually elongate, with the precervical portion shield-shaped, hard, with the frontal margin truncate, produced to a slight rostral point and a pair of subequal, submedian points, one each above the inner angle of the antennal base, beyond which point the outer portion of the frontal margin of the carapace recedes obliquely. The postcervical region is elongate, wider posteriorly, encased in a tough, leathery membrane which is marked by definite longitudinal wrinkles and beset with small clusters of long, golden setae. The abdominal terga are well defined. The pretelsonic segment is squarish, calcified. The telson is but very little asymmetrical, the left side being the larger; both lateral and distal telsonic margins are each medially incised and very little rounded. The uropoda are almost equal, both rami with a scabrous external surface and the margins setose.

The eyestalks, including the cornea, are equal in length to the antennular peduncle, or about one millimeter longer than the antennal peduncle; or about as long as the frontal margin of the carapace, slender, curved, with numerous long, golden, solitary setae on the upper surface; the cornea are terminal, hemispherical, appearing to possess slightly wider diameter than the related stalk. The ophthalmic scales are side by side, nearly touching proximally, slightly separated distally; as wide proximally as long, with the outer lateral border excavate medially, the distal portion a blunted triangle with a small spinule at the apex; margins setose.

The antennal acicule is nearly half as long as the eyestalk, slender, acuminate, spinose and quite setose, nearly covering the second peduncular article and overlapping the base of the third article; the second peduncular article has a small spinule at the distal dorsal end; the third article extends almost to the distal margin of the stalk; the flagellum is thickish and extends to mid-way the dactyl of the first ambulatory leg.

The chelipeds are subequal, the merus laterally compressed, with the upper margin setose, ornamented with a series of white spots (preserved specimen), a few of these spots are elevated and margined anteriorly by transverse rows of setae; the inner, lower meral margin is serrated; the carpus is similarly compressed, but more robust, with many more distal spines; the propodus is short, definitely deflected, no longer than the merus; the

palm is dilated, globose inferiorly, about as wide as long at the base of the fingers; the outer surface of the palm is flattish, covered with a series of coarse, conical spines, each of which is white with a black tip and has a tuft of long setae at the base; these spines and setae are continued on the fingers, the spines decreasing in length toward the finger-tips, which are black, corneous, hollowed, the inner cavity filled with a tuft of setae; there is a very narrow gap between the bases of the closed fingers.

The second pair of ambulatory legs is the longest of the series, having the right and left legs of the pair subequal, each exceeding the length of the chelipeds by the distal third of the propodus and the entire dactylus; their surfaces are smooth, except for punctae, and they are beset with tufts of golden bristles, which are most abundant on the dorsal and ventral margins, especially so on the dactyli. The dactyli are only two-thirds as long as the related propodi, which are all subcylindrical; the dactyli have strong, curved, hook-like black tips.

The third pair of legs are unequal, the right one being the longer and extending three-fourths the length of the dactyl of the adjacent second leg, while the left third leg is only as long as the chelipeds, or extends almost to the base of the dactyl of the second left leg. The propodus of the left third leg has the outer surface decidedly flattened and thickly hirsute.

The fourth pair of legs are subchelate and the fifth pair are weakly chelate.

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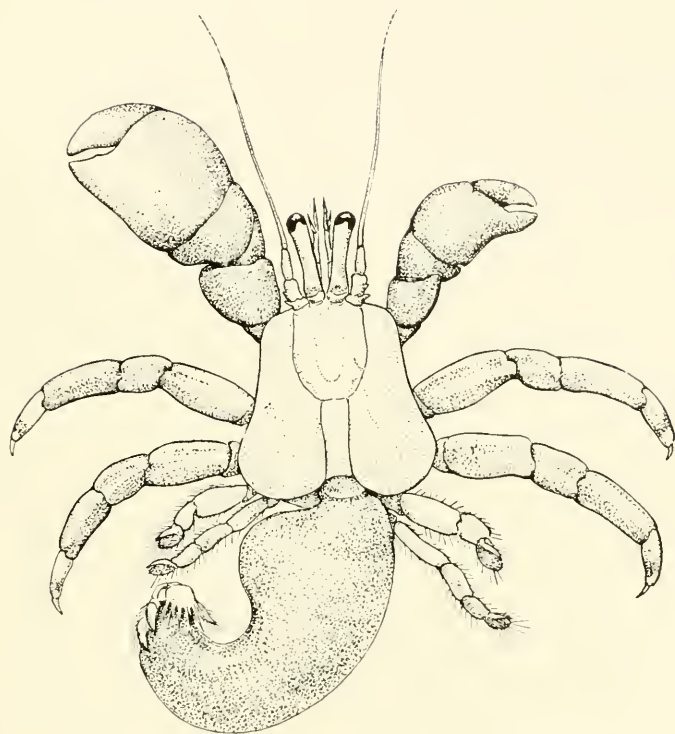
Genus: *CALCINUS* Dana

Calcinus herbstii de Man

Plate 2

TYPE: Dr. de Man's type series is from Edam Island, Noordwachter Island, and Halmahera Islands, and is deposited in the Leyden Museum.

DISTRIBUTION: This species has a very wide distribution, being known from Japan, southward to the Natal coast, South Africa, and eastward to the Hawaiian Islands and Paumotu Archipelago. It is recorded from: Zanzibar, Mozambique (Hilgendorf); Mozambique (Miers); Madagascar (Lenz and Richters); Tulear, Madagascar (Lenz); Natal coast, S. Africa (Krauss); Mauritius (Alcock); Grand Port, Mauritius (Bouvier); Rodriguez Island (Miers); Diego Garcia (Balss); Malé Atoll, Maldive Islands (Ortmann); Goidu, Maldives, Minikoi Island (Borradaile); Subheli-par, Laccadives (Henderson, Alcock); Great Sober Island, Trincomalee, Ceylon (Henderson); Trincomalee (Muller); Andaman Islands; reefs of Great Cocos Island; Palk Strait (Alcock); Nicobar Islands (Heller); Bonin Islands, Loo Choo Islands, Ousima, Japan (Stimpson); Amami Oshima, Japan (Ortmann); Straits of Balabac, North of Borneo (Dana); Edam Island, Noordwachter Island, Borneo, Halmahera Islands, Brava (de Man); Pleasant Island, Nauru Island, Gilbert Islands (Whitelegge); South Seas (H. M. Edwards, Alcock); Funafuti Atoll, Ellice Islands (Whitelegge, Borradaile); Rotuma (Borradaile); Apia, Samoa (Boone); Tutuilla, Samoa, Wake Island (Dana); Fanning Islands, "one of the most common species in the Hawaiian Islands" (Edmondson); Hawaiian Islands (Streets, Randall, Dana); on the reefs, Tahiti, Society Islands (Henderson, Hilgendorf, Heller, Nobili); Paumotu Archipelago: Raraka, Vincennes, Carlshoff



Calcinus herbstii de Man, $\times 2$.

Island, Waterland Island (Dana) ; Hao Island (Nobili) ; Tagatau, Hikueru, Marutea, Fakahina, Rikitea, Puamu, Taraourouroa, Kamaka (Nobili) ; Bencoelen (Nobili).

MATERIAL EXAMINED: Twelve specimens taken on the reefs, at Apia, Samoa, September 5, 1931, by the "Alva." One ovigerous female carries about 500 eggs.

TECHNICAL DESCRIPTION: Carapace elongate, precervical portion well calcified, rostrum a minute point, the antennal points even less defined; the posterior margins of this region are rounded. The postcervical region is widest across the branchial region, the integument, including that of the median plate, flaccid. The abdomen is well developed, soft, spirally coiled; the terga are thin, widely separated on the second to fifth segments, inclusive; there are, on the left side, four biramous appendages, one on each segment. On the fifth segment the appendage is reduced. The telson and uropoda are symmetrical, being larger on the left side.

The eyestalks are stout, slightly curved, barely equal to, or about a millimeter longer than, the width of the frontal border of the carapace, or about one-sixth longer than the antennular peduncles. The antennal peduncles are only three-fourths as long as the eyestalks. The ophthalmic scales are sublobate, with the tips acute, directed inward. The antennal acicule is stout, triangulate, with both lateral margins serrulate, the tip acute, reaching almost to the base of the distal peduncular segment; the flagellum is stout, extending to midway the finger of the large cheliped.

The chelipeds are decidedly unequal, the left one being decidedly the larger; both are smooth, unarmed, the margins being entire. The left one is one and one-third times as long as the entire carapace, with the merus short, trigonal, higher than long, the upper surface rounded, with a deep, oblique groove across the proximal inner portion; the height of the palm equals the upper margin; the outer surface is rounded, paved with microscopic granules; the lower finger is short, the tip pointed and there is one triangulate tooth on the cutting edge. The upper finger is more curved, also pointed distally. There are several clusters of bristles on the inner surface of the cutting edges of both fingers, which meet throughout their length. On the lower proximal part of the inner surface of the palm, there are several flattish, squamiform scales or elevations. The right, or smaller, cheliped is much

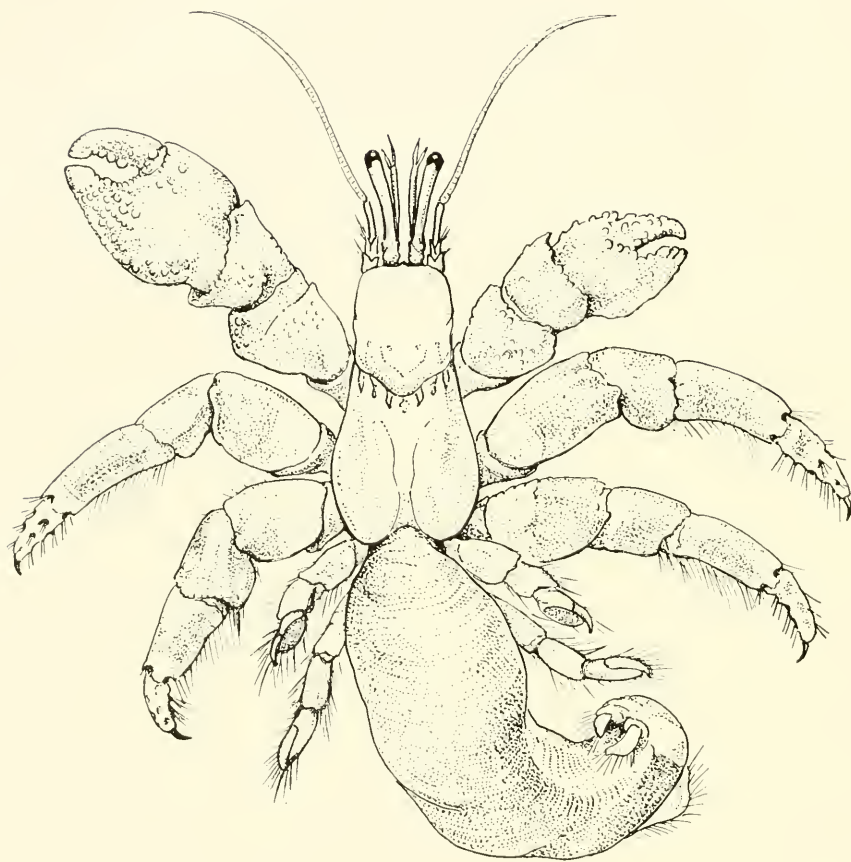
more compressed laterally on the carpus and propodus and has no oblique groove on the former; the fingers meet throughout their length and have the tip rounded, inwardly hollowed, spoon-like, with a few series of bristles inside and outside the tip.

The second and third pairs of legs are similar, nearly equal to each other, the second pair being slightly the longer and extending to only about midway the palm of the larger cheliped. The joints of the ambulatories are smooth, except for the punctae, laterally compressed; the carpus with a small tooth at the upper distal margin; the dactyl with a small, circular depression on the outer side near the proximal end; the tip is a strong, curved, horny claw; there are numerous clusters of bristles along the lower surface and also one or two thorny spinules.

The fourth pair of legs is very slender, much reduced, reaching only halfway the length of the merus of the third pair of legs and being weakly subchelate. The fifth pair of legs is very slender, weakly chelate.

COLOUR: Although the present specimens have been three years preserved in alcohol, they have the legs and eyestalks orange-red, the distal portion of the chelipeds white, including the outer half of the palm and fingers of the larger cheliped. The dactyli of the second and third pairs of legs are white with a small red dot on the proximal outer surface and are transversely banded subdistally with red; the tips are horny, brownish black.

Calcinus herbstii, DE MAN, J. G., Archiv. f. Naturg., Bd. LIII, heft I, 1887, p. 437; Ann. Mus. Genov., ser. 2, t. XIX, 1898, p. 270; Senckenb. Naturf. Gesellsch. Abh. Frankfurt, Bd. XXV, 1900-01, pp. 474, 740.—ORTMANN, A., Zool. Jahrb. Syst., Bd. VI, 1892.—HENDERSON, J. R., Journ. Asiatic Soc. Bengal, vol. LXV, 1896, pt. II, p. 518.—BORRADAILE, L. A., Proc. Zool. Soc. London, 1898, p. 462.—NOBILI, G., Ann. Mus. Genova., ser. 2, t. XX, 1900, p. 493.—BORRADAILE, L. A., Faun. and Geogr. Maldive and Laccadive Arch., vol. II, pt. III, 1901-03, p. 828.—WHITELEGGE, T., Rec. Austral. Mus. Sydney, vol. V, 1903-05, p. 12.—ALCOCK, A., Catal. Indian Decap. Crust. Coll. Indian Mus., pt. II, Anomura, Fasc. I, Pagurides, 1905, p. 53, pl. 5, fig. 4.—NOBILI, G., Mem. Torino R. Accad. Sci., ser. 2, t. LVII, 1907, p. 368.—LENZ, H., Reise in Ost-Afrika Wiss. Ergebn. II Syst. Stuttgart, 1906-10, p. 565.—BALSS, H.,



Calcinus elegans (H. M. Edwards), $\times 2$.

Wiss. Ergebn. Deutsch. Tiefsee Exped., Bd. XX, Afg. II, 1912, Jena, p. 93.—BOUVIER, E. L., Bull. Sci. Franc.-Belg., t. XLVIII, 1914-15, p. 207.—EDMONDSON, C. H., Bull. B. P. Bishop Mus., vol. V, 1923, p. 20.

Pagurus laevimanus, RANDALL, J., Journ. Phila. Acad. Nat. Sci., vol. VIII, 1839, p. 135 (*vide* Dana).

Pagurus tibicen, EDWARDS, H. M., Ann. Sci. Nat. Zool., ser 2, t. VI, 1836, p. 278.—*Ibid.*, ser. 3, t. X, 1848, p. 63; Hist. Nat. Crust., t. II, 1837, p. 229; in CUVIER, Règne Anim., ed. 3E, pl. 44, fig. 3.—KRAUSS, F., Sudafrik. Crust., 1843, p. 57.

Calcinus tibicen, DANA, J. D., U. S. Explor. Exped., vol. XIII, pt. I, Crust., 1852, p. 457.—STIMPSON, W., Proc. Phila. Acad. Nat. Sci., vol. X, 1858, p. 247 (issued 1859).—HELLER, C., Reise Oesterreich. Fregatte "Novara" Crust. Zool., theil II, Abth. III, 1865, p. 87.—HILGENDORF, F., in von der Decken, Baron, Reisen in Ost-Afrika, Wissensch. Ergebn., Bd. III, Abth. I, Crust. 1869, p. 97; Monatsb. K. Akad. Berlin, 1878, p. 823.—STREETS, T. H., Bull. U. S. Nat. Mus., vol. VII, 1877, p. 116 (issued 1878).—MIERS, E. J., Phil. Trans. Roy. Soc. London, vol. CLXVIII, 1879, p. 491; Rept. Zool. H. M. S. "Alert," 1884, pp. 519, 557, London.—RICHTERS, F., in Möbius, K. A., Beitr. Meeresfaun. der Insel. Mauritius und Seychellen, 1880, p. 161.—LENTZ, H., and RICHTERS, F., Abh. Senckenb. Naturf. Gesellsch., Bd. XII, 1880-81, p. 426.—MULLER, F., Verh. Naturf. Gesselsch. Basel., Bd. VIII, 1886-90.—HENDERSON, J. R., Rept. Voy. H. M. S. "Challenger," vol. XXVII, 1888, p. 61.—WHITELEGGE, T., Mem. Austral. Mus. Sydney, vol. III, 1897, p. 144.—STIMPSON, W., Smiths. Misc. Coll., vol. XLIX, 1907, p. 208.

Calcinus elegans (H. M. Edwards)

Plate 3

TYPE: Dr. Milne Edwards' type was secured by M. Quoy and Gaimard, at New Ireland, and is deposited in the Paris Museum.

DISTRIBUTION: This species has about the same distribution as *Calcinus herbstii*, being widely distributed in the Indo-Pacific Ocean.

It has been recorded from the following places: Natal, S. Africa, in *Nerite plicata* (Krauss); Mauritius: Grand Port (Bouvier); Mauritius and Seychelles Islands (Richters); Diego Garcia (Balss); Salomon, Chagos (Laurie); Manadu, Addu, Maldives; Minikoi (Borradaile); Laccadives: Subhelipar (Alcock, Henderson); Rodriguez Island (Miers); South Seas (Ortmann); Loo Choo Islands (Stimpson); New Ireland (H. M. Edwards); Ellice Islands: Funafuti Atoll, abundant in pools of the outer reef; encased in eight different kinds of mollusks (Whitelegge); Funafuti (Borradaile); Rotuma (Borradaile); Fiji Archipelago (Boone); Hawaiian Islands (Dana, Randall); Oahu, Sandwich Islands (Owen); Laysan Island (Lenz); Marcus Island (Bryan); Wake Island (Dana); Palmyra and Fanning Islands (Edmondson); Tahiti, Society Islands (Heller, Boone); Paumotu Islands; Mangareva Island, Gambier Islands (Nobili).

MATERIAL EXAMINED: Four specimens taken on Venus Point Reef, Tahiti, Society Islands, August 15, 1931. One specimen, Bora Bora, Society Islands. One specimen, Suva, Vitu Levu, Fiji Islands, September 9, 1931.

This species may be distinguished from *Calcinus herbstii* by the following characteristics: The eyestalks are slenderer and longer, being one and one-third times the width of the frontal margin of the carapace.

The antennal acicule, with both margins spinose, extends above the base of the last peduncular joint of the antennae; the flagellum is only four-fifths as long as the carapace. The antennular peduncle is four-fifths as long as the eyestalks.

The inequality of size is not so great between the chelipeds, the larger, or left one, being less massive than that of *C. herbstii*; the merus has both inferior margins serrate and a few spines on the distal border; the carpus has the oblique groove of the proximal upper surface broader but less decisive, and there are numerous coarse granules on the upper, inner and distal borders of the carapace; the propodus has the upper and especially the lower border set abundantly with small, low, rounded, pearly granules; these granules are larger on the lower border and pave the region adjacent to the fingers. The fingers meet only at the tips and are thickly beset on their upper, outer and lower surfaces with numerous pearly granules. The smaller right cheliped has the upper

and both lower borders of the palm serrate; the carpus is also serrate on the upper margin; the propodus has the upper margin serrate, the distal portion of the palm and both fingers beaded with pearly granules as on the larger cheliped; the fingers meet throughout their length.

The second and third pairs of legs have the inferior margin of the dactyl setose; the setae on the second leg being in small, bristly clusters, while on the third leg the bristles on this margin of the propodus and dactyl form a thick brush, composed of large tufts of setae set close together.

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Calcinus elegans, DANA, J. D., U. S. Explor. Exped. Crust., vol. XIII, pt. I, 1852, p. 458, atlas, pl. 28, fig. 10a-c.—STIMPSON, W., Proc. Phila. Acad. Nat. Sci., vol. X, 1858, p. 247 (issued 1859).—HELLER, C., Reise Oesterreich. Fregatte "Novara" Crust., Bd. II, Abh. III, 1865, p. 88.—TOZZETTI, T., Magenta Crost., 1877, p. 229.—MIERS, E. J., Phil. Trans. Roy. Soc. London, vol. CLXVIII, 1879, p. 492.—RICHTERS, F., in Möbius, K. A., Meeresfaun. Mauritius und Seychellen, 1880, p. 161.—DE MAN, J. G., Notes Leyden Museum, vol. XII, 1890, p. 108.—ORTMANN, A., Zool. Jahrb. Syst., Bd. VI, 1892, p. 294.—HENDERSON, J. R., Journ. Asiatic Soc. Bengal, vol. LXV, pt. 2, 1896, p. 519.—WHITELEGGE, T., Mem. Australian Mus., vol. III, 1897, p. 143.—BORRADAILE, L. A., Proc. Zool. Soc. London, 1898, pt. II, p. 461; Fauna and Geogr. Maldives and Laccadive Arch., vol. II, pt. 3, 1901-03, p. 829.—LENZ, H., Zool. Jahrb. Syst., Bd. XIV, 1901, p. 444.—BRYAN, W. A., Occas. Papers B. P. Bishop Mus., vol. V, 1902-06, p. 26.—ALCOCK, A., Catal. Indian Decap. Crust. Coll. Indian Mus., pt. II, Anomura, fasc. I, 1905, p. 55, pl. 5, fig. 2.—STIMPSON, W., Smiths. Misc. Coll., vol. XLIX, 1907, p. 208.—NOBILI, G., Mem. Torino R. Acc. Sci., ser. 2, t. LVII, 1907, p. 368.—BALSS, H., Wiss. Ergebn. Deutsch. Tiefsee Exped. "Valdivia," Bd. XX, 1912, p. 93, fig. 2.—BOUVIER, E. L., Bull. Sci. Franc-Belg., t. XLVIII, 1914-15, p. 206.—EDMONDSON, C. H., Bull. B. P. Bishop Mus., vol. V, 1923, p. 26.—LAURIE, R. D., Trans.

Linn. Soc. London Zool., ser. 2, vol. XIX, p. 155.

Pagurus pictus, OWEN, R., Zool. H. M. S. "Blossom" Crust., 1839, p. 83, pl. 25, fig. 2.

Pagurus decorus, RANDALL, J. W., Journ. Phila. Acad. Nat. Sci., 1839, p. 134.

Genus: **DIOGENES** Dana

Diogenes diogenes (Herbst), ss. Henderson

Plate 4

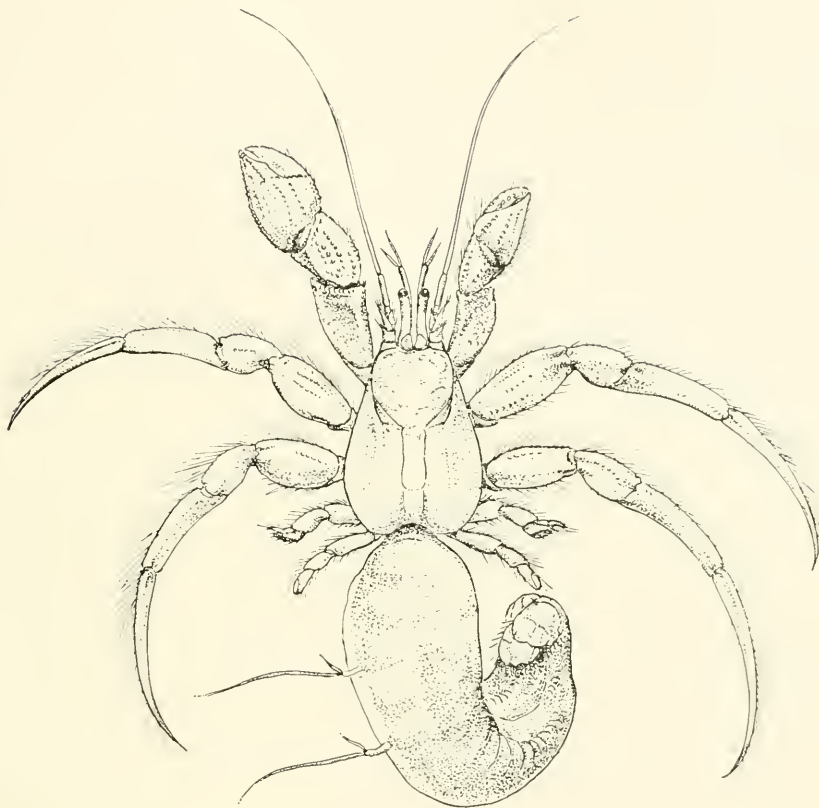
TYPE: Herbst's type came from the East Indies and is deposited in the Berlin Museum.

DISTRIBUTION: Owing to the confusion of names, it is not feasible to give the full distribution of this species. Dr. Alcock records it as common off the east coast of the Indian peninsula, in depths varying from 6 to 68 fathoms, citing material from five localities. The "Alva" record from Dorian Strait substantially extends the distribution of this species.

MATERIAL EXAMINED: One specimen, dredged in 14 fathoms, on muddy bottom, on the Equator, to the south of South Brother's Island, south entrance of Dorian Strait, Lat. 29° N., Long. 104° 47' E., November 6, 1931.

TECHNICAL DESCRIPTION: Carapace about one-fourth longer than its greatest width, which is across the branchial region; pre-cervical portion of the carapace slightly wider than its greatest length; frontal margin excavate and finely serrulate at the base of the ophthalmic segments; lateral margins also somewhat spinulose; the dorsal surface is well calcified, with numerous spinules, coarse granules and serrate transverse ridges; the postcervical region is covered by tough integument with numerous vesiculous granules and abundant tufts of setae on the branchial region. The abdomen is very coiled, soft, the terga widely separated; the appendages are restricted to the left side of the second to fifth segments, inclusive; these appendages are uniramous in the male, but on the second, third and fourth segments of the female they are biramous; the telson and uropoda are calcified, asymmetrical, being larger on the left side.

The rostrum is one and three-fourths times as long as the ophthalmic scales, or more than a third of the length of the eye-



Diogenes diogenes (Herbst), s.s. Henderson, $\times 2$.

stalks, with the entire margins and tip spinose. The eyestalks are clavate, larger proximally, somewhat compressed laterally, four-fifths as long as the frontal width of the carapace; the cornea is one-fourth of the total length; a little longer than the second joint of the antennulae and only reaching midway the distal peduncular article of the antennae. The ophthalmic scales are large, obliquely truncated and spinulose distally.

The antennal peduncle extends to about midway the distal peduncular joint of the antennulae; the antennal acicule is bifurcate, with the opposed margins of the forks spinulose; the outer fork is the longer, barely reaching to the base of the distal peduncular joint; the inner fork reaches to about midway the second peduncular joint; the flagellum is very slender, about one and one-half times as long as the carapace.

The chelipeds are markedly unequal, the left being the larger; both are very spinose and also have their margins very setose. The left cheliped is nearly twice as long as the carapace, the merus, carpus and propodus being of subequal length; the merus is trigonal, the margins being spinulose or granulose, the outer surface is granulose; the carpus is triangular, longer than wide, with a sinuous groove, nearly smooth, on the upper surface; the palm of the propodus is a little higher than long, with the outer surface slightly convex; the upper finger is one and one-half times as long as the upper border of the palm; the fingers meeting, with the tips corneous, black. The upper and lower margins of the fingers and palm are distinctly spinose; there is a wide, oblique area on the outer surface of the palm in which spines are scarce or lacking; the spines of the palm are procurved, or claw-like. The upper finger has a double longitudinal row of spines on the upper surface. The smaller cheliped is similarly spinose setose, the setae appearing longer, owing to the smaller sized claw.

The second and third pairs of legs have the upper lateral margins of the meral, carpal and propodal joints spinose, the outer surfaces granulose; the propodi are fluted, with spines on the upper surface; the dactyli are long, slender, curved, with a longitudinal sulcus on the outer face; the dactyli are abundantly fringed on their margins with long, silky setae. The legs of the left side are shorter than those of the right side, scarcely exceeding in length the great cheliped, while on the right side, they exceed this

by about half the length of their dactyli. These dactyli are each one and one-half times as long as their related propodi.

The fourth pair of legs is subchelate. The fifth pair is weakly chelate; both pairs have patches of imbricated, corneous scales on the propodal-dactylar areas.

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Pagurus miles, FABRICIUS, J. C., *Ent. Syst. Suppl.*, 1798, p. 412.—EDWARDS, H. M., *Ann. Sci. Nat. Zool.*, ser. 2, t. VI, 1836, p. 284 (*nec* pl. 14, fig. 2).

Genus: *Pagurus* Fabricius

Pagurus deformis H. Milne Edwards

Plate 5

TYPE: Dr. Milne Edwards' type series was collected on the coasts of Ile de France, (Mauritius), and of the Seychelles Islands and is deposited in the collections of the Paris Museum d'Histoire Naturelle.

DISTRIBUTION: This species has been many times recorded from the area between approximately Long. 40° E., to 150° W. and from Lat. 28° N. to the Society Archipelago and Hawaiian Archipelago. The following localities have been cited for it: Red Sea (Nobili); Dar-es-Salaam (Ortmann); Coasts of Mozambique (Hilgendorf); Madagascar (Lenz and Richters); Nossi Bé, Madagascar (Gravier, Lenz); Seychelles Islands (H. M. Edwards, Richters); Durban, South Africa (Stebbing); Mauritius, Ile de France (H. M. Edwards); Grand Port, Mauritius (Bouvier); Reunion Island (A. M. Edwards); Chagos, Egmont, Lagoon (Laurie); Maldive Archipelago: Hulule, Mamadu Addu; Laccadive Archipelago (Borradaile); India, Rameswaram, Tuticorin (Henderson); Chokirbank, Ras Rangoni, Trincomalee, Ceylon (Muller); Andaman Islands, Mergui (Alcock); Owen Island, Mergui Archipelago (de Man); Borneo, Pulo Edam Island (de Man); Philippine Islands (White, Miers); Ousima, Japan (Stimpson); Straits of Balabac (Dana); Ternate (de Man); Timor



Pagurus deformis H. M. Edwards, two-thirds of natural size.

(Hilgendorf) ; Southport, Queensland (Boone) ; Australia (White, Miers) ; Amboina Island, Moluccas (Ortmann, Hilgendorf, Zehntner) ; British New Guinea (Borradaile) ; Anchorites Islands (Hilgendorf) ; New Britain, Conflict Islands (Borradaile) ; New Ireland (Hilgendorf) ; Lifu, Loyalty Islands, Rotuma (Borradaile) ; Fiji Islands (Dana) ; Society Islands, Tahiti (Heller) ; Papeete, Tahiti (Henderson) ; Venus Point Reef, Tahiti (Boone) ; Sandwich Islands (Randall) ; Marokau, Fakahina, South Marutea, Hao Island, Paumotu Archipelago, Vaiatu Kene, Mangareva (Nobili).

MATERIAL EXAMINED: One large specimen, Southport, Queensland, September 24, 1931. One specimen, Venus Point Reef, Tahiti, Society Islands, August 15, 1931, carcinocaecum, *Nerita* species.

TECHNICAL DESCRIPTION: Precervical portion of carapace squarish, wide as long, frontal margin truncate, except for the paired submedian triangulate points, one each between the base of the eye and the external antennae. Lateral margins rough with denticles and tufts of coarse setae. A wide, U-shaped, linear groove is anterior to the posterior margin. The postcervical region is leathery with longitudinal striations. The abdomen has three transverse, leathery bands dorsally; the pretelsonic and telsonic segments are calcareous, the left side and left uropod being much the larger.

The ocular scales are triangulate with the apices directed inward.

The eyestalks are thick, their length including the cornea, equal to one-half of the frontal margin, the width of the stalk being about one-half of the total length; dorsally having a rounded process extended upon the cornea; the latter is terminal, hemispherical, black, a trifle wider than the stalk.

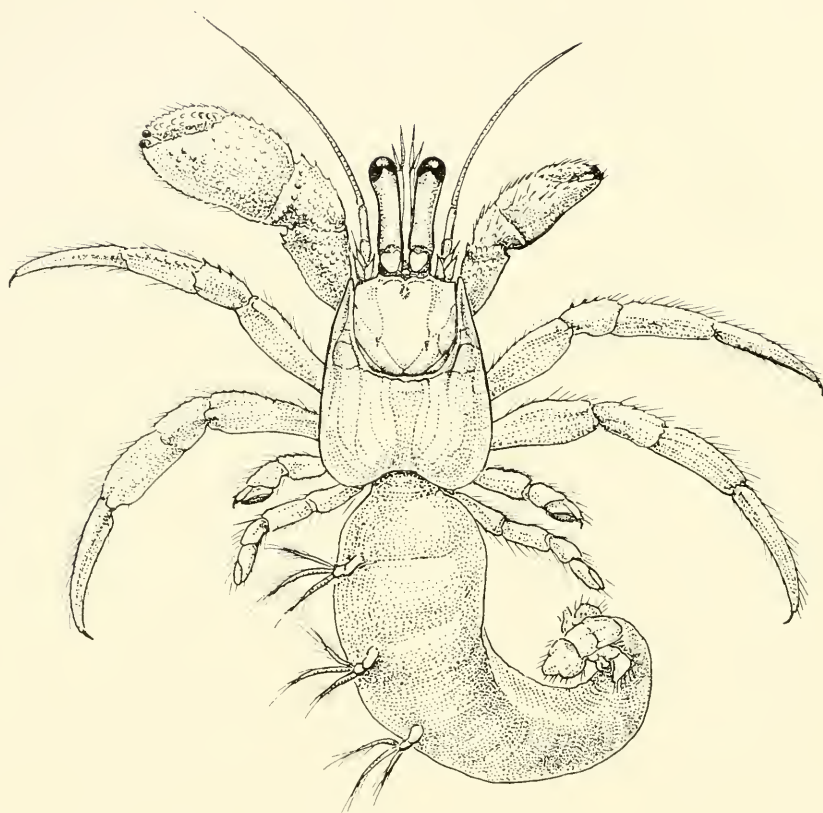
The antennulae are slender, exceeding the length of the eye by about one-half of the length of the distal peduncular article and flagellum.

The antennae have the basal article squarish, with the external distal angle acute, the acicule narrow, tapered, triangulate, the tip not quite reaching the base of the cornea; the second joint is small, semiconcealed beneath the acicule; the third article is slender, elongate, extending as far as does the cornea; the flagellum is multiarticulate, about one and one-half times as long as the entire carapace.

The chelipeds are conspicuously unequal, as figured (Plate 5); the larger cheliped has the merus trigonal, with the inner, inferior lateral margin coarsely serrate; the carpus with the upper surface and inner lateral margin spinose; the palm is high, swollen, with the upper margin spinose in two or three close-set series and with two additional longitudinal rows, the lower one of which terminates between the base of the fingers; the lower half of the palm is smooth, except for the coarse denticles of the lower margin. The fingers are stubby, the upper one with three rows of denticles on the outer and upper surface; the lower finger smooth, except along the lower margin; the teeth are both contiguous, low, bluntly serrulate. The smaller cheliped extends only to the base of the dactyl of the second pair of legs, is ornamented with series of spines similar to those of the larger cheliped, in addition to which the smaller cheliped has numerous tufts of setae. The fingers are as long as the palm, meeting, with corneous black tips.

The right and left legs of the first and second pairs are subequal on opposite sides, the second pair of ambulatory legs exceeding the first pair in length by about one-fifth of the length of the dactyl. The meral, carpal, and propodal joints are compressed, the dorsal surface roughened with obscure denticles, except two or three coarse ones at the distal end of the carpus; the dactyli are long, curved, sharp-tipped, beset with numerous tufts of setae. *The dactyl of the second leg on the left side* is distinguished from the others by having a deep longitudinal groove, accentuated by a median longitudinal ridge and with the upper margin serrulate.

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Pagarus dearmatus Henderson, $\times 2$.

und RICHTERS, Ahb. Senck. Nat. Ges., Bd. XII, 1881, p. 426.—MULLER, F., Verh. Naturf. Gesellsch. Basel, Bd. VIII, 1886, p. 472.—DE MAN, J. G., Arch. f. Nat. Gesellsch., Bd. LIII, I, 1887, p. 435; Journ. Linn. Soc. Zool. London, vol. XXII, 1888, p. 225.—HENDERSON, J. R., Rept. Voy. H. M. S. "Challenger," Zool., Anomura, vol. XXVII, 1888, p. 57; Trans. Linn. Soc. Zool., London, ser. 2, vol. V, 1893, p. 420.—ORTMANN, A., Zool. Jahrb. Syst., vol. VI, 1892, p. 288; also in Semon's Forschungsr. in Australien, Bd. V, 1894, p. 31.—ZEHNTER, F., Revue Suisse Mus. d'Hist. Nat. de Zool. Geneve, t. II, 1894, p. 191, pl. 8, fig. 20.—BORRADAILE, L. A., Proc. Zool. Soc. London, 1898, p. 460; also in WILLEY'S, Results Zool. Exped. to N. Britain, N. Guinea, Loyalty Isles and Elsewhere, 1899, p. 424.—DE MAN, J. G., Senckenb. Naturf. Gesellsch., Abh. XXV, 1900-03, p. 474.—ALCOCK, A., Fauna and Geogr. Maldive and Laccadive Archipel., vol. II, pt. 3, 1902, p. 832; Catal. Indian Decapod Crust., pt. 2, fasc. I, Anomura, 1905, p. 88, pl. 9, fig. 4.—LENZ, H., Reise in Ostafrika, 1903-05, Wissensch. Ergeb., Bd. II, 1906, p. 562, Stuttgart.—NOBILI, G., Mem. Torino, R. Accad. Sci., ser. 2, t. LVII, 1907, p. 370.—BOUVIER, E. L., Bull. Sci. Franc-Belg., t. XLVIII, 1914-15, p. 209.—STEBBING, T. R. R., Ann. Durban Mus., vol. V, 1917-20, p. 21.—GRAVIER, CH., Bull. Paris Mus. d'Hist. Nat., t. XXVI, 1920, p. 378.—LAURIE, R. D., Trans. Linn. Soc. Zool., London, ser. 2, vol. XIX, 1926, p. 158.

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Pagurus cavipes, WHITE, A., Proc. Zool. Soc., London, 1847, p. 122; Ann. Mag. Nat. Hist., ser 2, vol. I, 1848, p. 224.

Pagurus cultratus, WHITE, A., List Crust. Brit. Mus. Nat. Hist., 1848, p. 60 (*vide* Miers).

Pagurus dearmatus Henderson

Plate 6

TYPE: This is an ovigerous female, in the shell of *Strombus variabilis* Sowerby, taken in 12 to 28 fathoms, Admiralty Islands, and is deposited in the British Museum of Natural History.

DISTRIBUTION: Admiralty Islands, "Investigator" Station 175, 28 fathoms (Henderson, Alcock); Fiji Islands, Bali (Boone); Ceylon and the Maldives (Alcock); Maldives, Haddumati Island, Mahlos Island (Borradaile); Saya de Mahla (Laurie).

MATERIAL EXAMINED: Two specimens, taken at Vitu Levu, Suva, Fiji Islands, September 9, 1931. One specimen, from coral, Temukus Roads, Bali, Dutch East Indies, October, 1931.

TECHNICAL DESCRIPTION: This species, thus far recorded from only five localities in over half a century of exploration, two of which are to be credited to the "Alva," belongs in the same group as *Pagurus deformis*, *P. varipes* and *P. asper*, which it closely resembles in many features. It is readily distinguished from all three of these species by the following: (a) *P. dearmatus* has the exposed upper and outer surface of the left cheliped evenly granulose, these granules along the upper or inner margin are only moderately enlarged towards the proximal end, where some of them become spinules, as they also do along the inner carpal margin; (b) the propodus of the third left leg has the outer surface granulose and pitted with the upper lateral margin serrulate beneath the tufts of setae. *P. dearmatus* agrees with *P. deformis* and differs from *P. varipes* and *P. asper* in having the outer surface of the dactyl of the third left leg canaliculate, this channel extending the entire length of the dactyl; on the related propodus a similar but less deep channel occurs on the upper side.

P. dearmatus agrees with *P. varipes* and *P. asper* and differs from *P. deformis* in having the dactyl of the larger cheliped granulose and non-carinate. It agrees with *P. asper* but differs from *P. deformis* and *P. varipes* in having a non-carinate outer border of the upper surface of the propodus of the third left leg.

The carapace has the precervical portion well calcified; the rostrum absent, the antennal points distinct; the dorsal surface is well calcified and marked with numerous lines. The postcervical portion has the anterior lateral and median regions moderately calcified, the other encasing integument tough; the branchial region is not greatly expanded. The abdomen is coiled, the terga well separated; the second to fifth segments, inclusive, each bear an appendage on the left side; in the female, these segments are triramous on the second, third and fourth segments, but on the fifth segment the appendage is rudimentary, uniramous. The pre-telsonic and telsonic segments are well calcified; there is a T-

shaped sinus on the proximal portion of the telson; the distal portion has the lateral margin incised, bilobed, and the distal margin posteriorly is also incised and bilobed, unequally produced, the left side being much the longer with the distal margin spinose-setose. The uropoda are asymmetrically paired, that of the left side being much the larger.

The eyestalks are short, exceeding the depth of the antennular peduncle by the depth of the cornea, or two-thirds as long as the frontal width of the carapace, thickish, wider distally; the cornea is one-third of the total depth of the eyestalk; the ophthalmic segment is exposed; the ophthalmic scales separated, short, bluntly triangular, with the apices blunt, directed inward, subdistally serrate.

The antennal peduncle is only two-thirds of the length of the eyestalk; the acicule is acute and extends to the basal margin of the third peduncular article; the flagellum is non-setose and extends not quite to the tip of the larger cheliped.

The chelipeds are unequal, the left one being much the larger, with the merus trigonal, the outer surface granulose and one distal spine at the lower angle; the carpus has the entire outer and upper surface granulose, these granules with a tendency toward spinosity on the upper (inner) margin; the propodus and fingers are granulose and a few of these granules on the upper margin near the proximal end are spinose, the interstices are finely setigerous; the fingers are short, meeting throughout their length, the tips corneous, blackish. The smaller, right, cheliped has the merus smooth, except for the spinose lower and distal border; the carpus and propodus, including the fingers, granulose on the entire upper and outer surface; the smaller cheliped appears to have more numerous long, solitary setae than occur on the larger one.

The second and third pairs of legs are similar, the third pair exceeding the second pair in length by about one-fifth of the length of the latter pair; both pairs of legs are slender, compressed, cylindrical, with the dactyl of the second pair one and two-thirds times as long as the related propodus and the dactyl of the third pair one and three-fourths times as long as the related propodus; the dactyli are slender, curved, setose, with a longitudinal sulcus on the outer lateral surface of all except that of the third left leg. This has the outer surface of the propodus granular and pitted, the upper margin serrulate beneath the setae; the related dactyl

with the upper surface canaliculate; the upper lateral margin non-carinate; the lateral margins setose.

The fourth pair of legs is weakly subchelate. The fifth pair of legs is small, slender, weakly chelate.

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Pagurus spinimanus H. M. Edwards

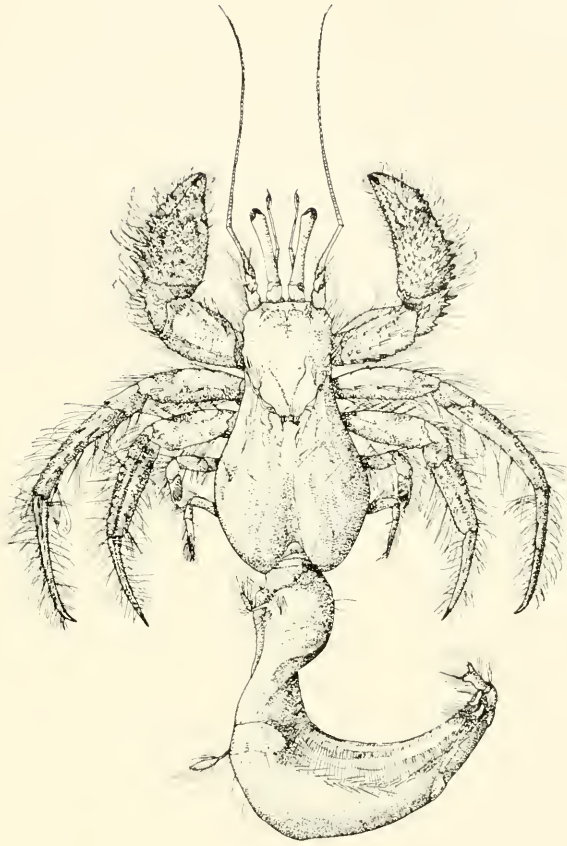
Plate 7

TYPE: Dr. Edwards' type was collected in the Seychelles Islands and is deposited in the Paris Museum.

DISTRIBUTION: This species is found from the Seychelles eastward to the Paumotu Archipelago, having been reported from the following localities: Seychelles (Edwards); Singapore (Ortmann); Sooloo Sea (Dana); Amboina, Moluccas (Zehntner); Society Islands, Tahiti (Boone); Friendly Islands, Tongatabu (Dana).

MATERIAL EXAMINED: One large male, taken on Venus Point reef, Tahiti, Society Islands, August 15, 1931, by the "Alva."

TECHNICAL DESCRIPTION: Carapace elongate, widest posteriorly, precervical region and cardiac area well calcified; frontal margin truncate, rostrum absent; a median transverse groove behind the rostrum is incised in the median line by a short groove and on either side behind the antennal angle is confluent with an irregular longitudinal line that runs backward and converges posteriorly, forming a wide V; there is also an oblique suture in the median lateral region. The lateral margins are heavily beset with setae, as are also the antennal peduncles and ophthalmic scales. The post-cervical region is semicalcified, widest posteriorly and with numerous tufts of setae along the frontal and anterior lateral areas. The abdomen is well developed, the encasing integument tough; the terga well delineated; the second to fifth segments, inclusive,



Pagurus spinimanus, H. M. Edwards, $\times 1$.

each bear on the left side a uniramous appendage in the male and in the female, a triramous appendage; these appendages are well developed on the second, third and fourth segments, but are rudimentary on the fifth segment. The telson is calcareous, asymmetrical, larger on the left side, as are also the uropoda.

The eyestalks are thickish, dilated distally, about five-sixths as long as the frontal width of the carapace, exceeding the antennular peduncle in length by about one-half the depth of the cornea, the antennular peduncle being subequal to the antennal peduncle. The ophthalmic segment is exposed. The ophthalmic scales are approximated, with their outer distal margins oblique, setose, the apices with two or more spinules each.

The antennae have the basal article with a sharp spine at both the outer and inner distal angles; the acicule is tapered, acute, the lateral margins spiny and setose, extending to the basal margin of the distal peduncular article; the flagellum is thickish, as long, or slightly longer than the carapace.

The male chelipeds are nearly equal in the present specimen, the left being slightly the larger; the merus is trigonal, with the anterior margin serrulate; the carpus is covered on its outer surface with a series of coarse, procurved, conical, thorny, acute spines, each of which has at its base one long and one or two shorter, stiff bristles. The spines are longer and sharper along the upper lateral margin. The propodus and fingers form an elongate oval, the palm being almost as high as long, the fingers are about as long as the palm. Both palm and fingers are covered on the entire outer surface by the same kind of spines and bristles described on the carpus; these spines are largest along the upper lateral border of the palm. The fingers meet throughout their length and each has a series of triangular teeth; the tips are corneous, black, rounded and hollowed inwardly and have tufts of bristles inside this concavity.

The second pair of legs is not so long as the third pair, which exceed in length by about the tip of the dactyl. Each leg has the merus very compressed laterally, the upper and lower lateral margins beset with tufts of setae, as also are those of the carpus; the upper and outer distal margin of the carpus is also spinose and setose; the propodus is about one-third shorter than the related dactylus and is armed with a double longitudinal line of spines accompanied by setae; the dactyl is beset with one longitudinal

line of spines on the upper surface and a series of tubercle-like elevations at the base of the setae clusters; the tip is horny, black, curved, and with one or two subdistal, horny spines on the inferior margin.

The fourth pair of legs is subchelate and the fifth pair is weakly chelate.

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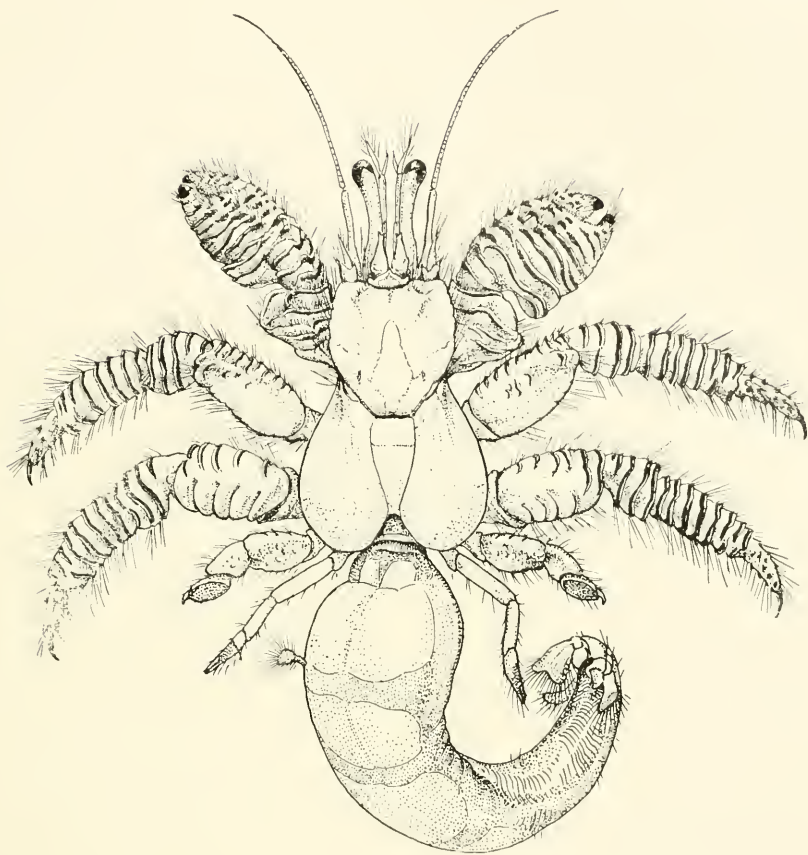
Genus: ANICULUS Dana
Aniculus aniculus (Fabricius)

Plate 8

TYPE: Fabricius' type came from the Indian Ocean, and if still extant, is probably in the British Museum of Natural History.

DISTRIBUTION: Mozambique, East Africa (Hilgendorf); Mauritius (H. M. Edwards, as Ile de France; Ortmann, Richters); Grand Port, Mauritius (Bouvier); Reunion Island (A. M. Edwards); Seychelles Islands (Hilgendorf, Richters, Miers); Rodriguez Island (Miers, Alcock); Coetivy (Laurie); India: Tuticorin, Muttuwartu Par, South India, Gulf of Manaar (Henderson); Kelantan (Lanchester); Japan (de Man); Japan: Sagami Bay, Tokio Bay (Ortmann); Simoda, Japan (Stimpson); Moretown Bay, Queensland, East Australia (McCulloch); Auckland, New Zealand (Thomson, Heller), New Zealand (Miers); South Seas (many early writers, Alcock, Cano); Ellice Islands: Funafuti Atoll (Whitelegge); Funafuti (Borradaile); Rotuma (Borradaile); Fiji Islands, Samoa (Miers); Society Islands (Alcock, Boone); Paumotu Archipelago, also Wake Island (Dana); Whitsunday Island (Owen); Marokau, South Marutea, Fakahina (Nobili).

MATERIAL EXAMINED: One specimen, taken on Venus Point Reef, Tahiti, Society Islands, August 15, 1931.



Aniculus aniculus (Fabricius) $\times 1.5$.

TECHNICAL DESCRIPTION: The carapace is much longer than its maximum width, which is two-thirds of the length; the pre-cervical portion is well calcified, marked by several longitudinal grooves and with a distinct, large, triangular rostrum, the tip of which barely touches the bases of the ophthalmic scales; a transverse groove defines the base of the rostrum and extends backward on the carapace on either side. The anterolateral angles of the carapace are rounded and the lateral margins are heavily fringed with coarse golden setae, which are also abundant across the front, on the basal articles of both pairs of antennae, the ophthalmic scales and eyestalks. Similar setae and shaggy bristles, red or yellow, occur on the chelipeds and legs. The postcervical portion of the carapace is widest across the branchial region, which is unusually well calcified and separated medially by a hard, longitudinal plate.

The ophthalmic scales are approximated, slightly separated distally, with the tips each cut into three or four smooth, conical teeth. The eyestalks are equal in length to the antennular peduncle, but are slightly shorter than the width of the frontal margin; the eyestalks are slightly dilated below the cornea, which is terminal, wide, hemispherical. There are ten to twelve clusters of bristles on the upper surface of the eyestalks.

The antennular peduncle is semiconcealed beneath the shaggy bristles on its dorsal surface; the flagellum is two-branched, the thicker, upper branch consists of about thirty rings and has a heavy, soft brush of setae on the under surface; the lower branch is much slenderer, consists of only about twenty rings, each of which bears a small, solitary bristle.

The first peduncular article of the antennae is short and wide, produced to a point on the outer side of the acicule, and beneath the acicule is produced on the inferior inner side to an elongate process that extends entirely beneath the second joint for its entire length; the latter is short, concealed dorsally by the acicule, which protrudes above the proximal two-fifths of the elongated third article; this acicule is very narrowed, pointed, distally spinose; the flagellum is thickish, extending to the tip of the cheliped and is beset with several fine, short setae on the distal margin of each ring.

The chelipeds are equal, short, the ischium produced to a short, blunt tooth on the inferior distal margin, interfitting into a cavity

of the lower surface of the merus, which is short, distally excavate for articulation with the down-bent carpus; compressed laterally, the upper edge shaggy with setae; there are about five transverse scuta on the outer surface, four of which are slightly interrupted, and all of which are fringed with short setae anteriorly; the carpus is short, compressed dorsally, with four or five transverse scuta on the upper portion, these diminished to two on the distal portion; the palm of the propodus is short and high, wider proximally than long, with six scuta on the rounded outer surface and two more on the short, stubby, lower finger; the distal three scuta of the carpus and all of those of the palm have on their upper portions little, black, thorny spines set in interrupted clusters; these are continued and the spines increase in number on the upper surface of the upper finger, which has five scuta. The finger-tips are wide, hoof-like; the distal surface smooth, not excavate, these tips black, hard; there are four or five short, tri-angulate, white teeth on the lower finger and three or four similar teeth on the upper finger, alternating with these.

The second pair of legs are subequal to each other and exceed the length of the chelipeds by about the length of their dactyli; the third pair of legs are also subequal to each other and exceed the length of the chelipeds by about half the length of their dactyli. Each of the ambulatory legs is laterally compressed, with the surface of the outer side covered by approximately equally spaced scuta like those of the chelipeds and on the upper margin each scutum bears two or three bristly black thorns in addition to the shaggy setae; the dactyl is tapered, the scuta being replaced on it by clusters of black, thorny spines in transverse series on the proximal portion and with the tip decidedly curved, sharp, black nail.

The fourth pair of legs is subchelate, the flattened, suboval propodus covered on the outer surface with a large patch of articulated squamae.

The fifth pair of legs is weakly chelate and has a patch of similar squamae on the outer surface of the palm and both fingers.

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Family: CENOBITIDAE

Genus: CENOBITA Latreille

Cenobita clypeatus Latreille

Plate 9

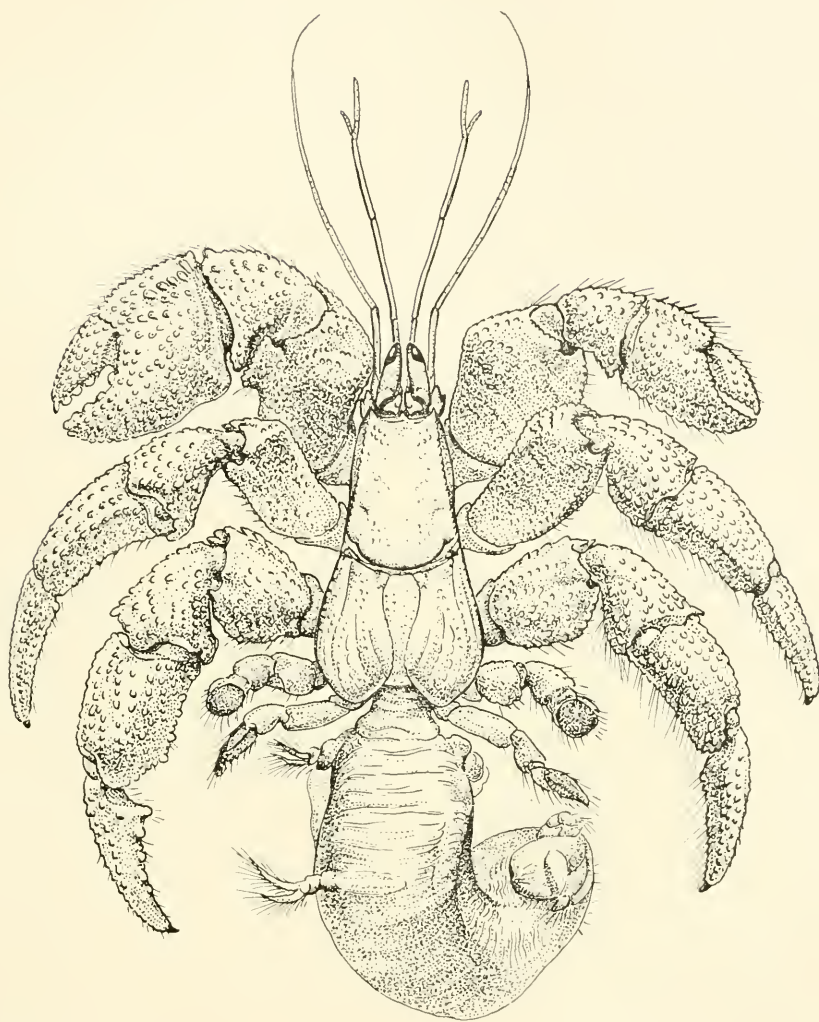
TYPE: Latreille's type came from the "seas of Asia" and is deposited in the Paris Museum.

DISTRIBUTION: This land-dwelling species has been recorded from tropical east Africa eastward to the Paumotu Archipelago. Bouvier has also recorded it from tropical west Africa. The following localities have been cited: Tropical west Africa (Bouvier); Ile aux Prunes, East Madagascar (Lenz); Seychelles Islands (Richters); South Seas (Alcock); seas of Asia (Edwards, Latreille); Maldives, at Goidu and probably elsewhere in this archipelago (Borradaile); Minikoi Islands (Borradaile); Subhelipar, Laccadives (Alcock); Watering Point, Galle, station 37, Gulf of Manaar (Southwell); Yé River, Burma, India (Alcock); Nicobar Islands (Heller); Pulo Edam Island, Noordwachter Island, Borneo (de Man); Kifa-juc, Malaysia (Nobili); Balabac Passage (Dana); Amboina Island, Moluccas Islands (Hilgendorf, Miers, Zehntner); Ternate Island (Hilgendorf); Emmahafen (Balss); Komoren (Hilgendorf); Funafuti Atoll, Ellice Islands (Borradaile, Whitelegge); Lifu, Loyalty Islands (Borradaile); Tahiti, Society Islands (Ortmann, Heller); Bora Bora, Society Islands (Boone); Hao Island, Amanu, Paumotu Archipelago (Nobili).

MATERIAL EXAMINED: Seventy-four specimens, Muller's Reef, Bora Bora Island, Society Islands, August 24, 1931.

TECHNICAL DESCRIPTION: This well characterized land-dwelling species has been repeatedly described by several authors, the majority of whom prefer to retain for it the name *C. clypeatus*, although recognizing, as pointed out by Hilgendorf, Alcock and others, that this may be challenged by nomenclature "lawyers."

The carapace has the precervical portion very convex dorsally and decidedly punctate; the posterior area less so. The rostral point is acute. The ophthalmic scales are laminate with the free margins serrulate. The antennulae have the peduncle about fif-



Cenobita clypeatus Latreille, $\times 9$.

teen to twenty percentum longer than the carapace; the basal article being nearly subequal in length to the antennal peduncle. The antennal peduncle exceeds the length of the eyestalk by the distal joint. The acicule is compressed, nearly lanceolate; not coalesced with the second peduncular article. The eyestalks slightly exceed the second antennal article in length and externally appear subcylindrical, but their inner surfaces are compressed and have sharp margins.

The chelipeds are unequal; each has the merus transversely rugose; the carpus is irregularly patterned with small vesicular tubercles which tend to become more numerous, coarser and spinose with horny tips along the margins; the palm and fingers are somewhat convex on the outer surfaces and similarly ornamented with vesicular tubercles. The larger cheliped bears along the upper portion of the inner surface a thick brush of coarse setae.

The second and third pairs of legs only slightly exceed the larger cheliped in length; each has the merus somewhat rugose and punctate on the outer surface, while the carpus, propodus and dactyl have their outer surfaces ornamented with tubercles similar to those of the chelipeds, these tubercles becoming more numerous and subspiniform on the dactyl. The inferior lateral margins of these legs, particularly on the right side, are setose. The left legs have the inner, concave surface of the dactyli distinguished by a fine linear, horny serrulate ridge.

Mr. Borradaile has given an excellent account of the morphology and habits of the oriental *Cenobites* in "Land Crustaceans" in the "Fauna and Geography of the Maldives and Laccadive Archipelagoes."

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Family: GALATHEIDAE

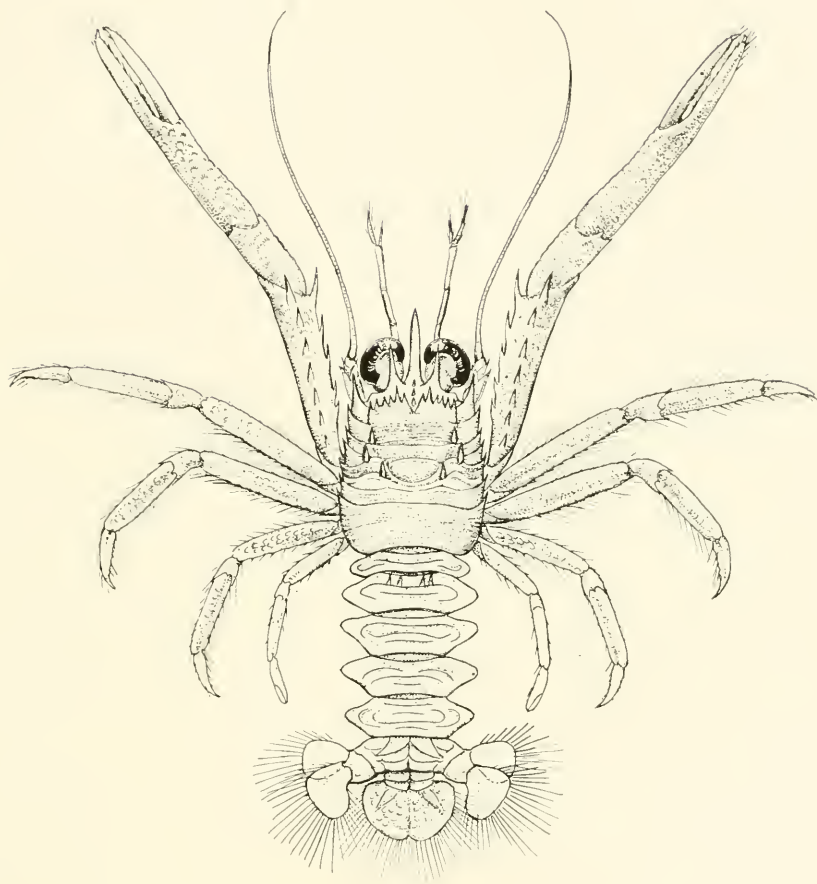
Genus: MUNIDA Leach

Munida militaris variety *andamanica* Alcock

Plate 10

TYPE: The type material of *M. militaris* typical form came from the "Challenger," Station 173, off Matuku, Fiji Islands (depth, 315 fathoms), and Station 192, off Little Ki Island (depth, 140 fathoms), and Amboina (depth, 100 fathoms); these are deposited in the British Museum of Natural History.

The type of *M. militaris curvirostris* Henderson was also taken by the "Challenger" and came from Station 200, off Sibago, P. I. (depth, 250 fathoms), and Station 210, off Zebu, P. I. (depth, 375 fathoms), and is likewise deposited in the British Museum.



Munida militaris variety *andamanica* Alcock, $\times 3$.

The type series of *M. militaris andamanica* Alcock came from the Andaman Sea, at ten stations of the "Investigator" at depths ranging from 173 to 405 fathoms, and from the Arabian Sea in the neighborhood of the Laccadive and Maldive archipelagoes at two stations, ranging from 210 to 360 fathoms, and is deposited in the Calcutta Museum.

DISTRIBUTION: Indo-Pacific, deep water.

MATERIAL EXAMINED: One young specimen taken from fish's mouth at Trong village, Admara Island, Solar Straits, Dutch East Indies, October, 1931, by the "Alva."

TECHNICAL DESCRIPTION: The front is produced into a strong, slender, acute, rostral spine, one-half or slightly more than one-half as long as the carapace, the distal third extending beyond the eyes, flanked by a pair of submedian, rostral spines, each about half or slightly more than half as long as the rostral spine. These spines are acute, laterally compressed, dorsally carinate. There is a strong acute spine about two-thirds as long as the submedian rostral spines, situated at the postorbital angle. The carapace is decidedly convex from side to side and broken by about fourteen transverse ridges, seven of which occur on the precervical portion of the carapace. The first of these ridges bears fifteen spinules in irregular series, one slightly larger, being on the anterolateral margin succeeded by six short ones, while the seventh spinule is also larger and is situated behind the submedian rostral spine; the eighth spinule is small and is on the median line. On the third transverse ridge there is a solitary spinule, a little in advance of the cervical sulcus, and in line with the third (from the outermost side) spinule of the first ridge. Posterior to the cervical groove there are two solitary spines on each side of the carapace; the anterior one of these is on the seventh ridge, at the inner edge of the ridge outside of the cervical groove and in line transversely with the third postcervical spinule, of the lateral margin. The other spinule is on the eighth transverse ridge, at its inner end, just behind the cervical groove. These transverse ridges are minutely granulose and fringed with short, silky, forward-directed setae. The second precervical ridge and first to fifth, inclusive, postcervical ridges each terminate in an acute, forward-directed spine on the lateral margin.

The abdominal segments are each marked by transverse ridges, but no spinules are present, except on the anterior margin of the

second segment, which bears about six, the inner two spines being widely submedian, the remaining four, two on each side near the outer lateral region. An encrusting growth on the carapace makes it impossible to say reliably whether or not there are more than six spinules here. On the anterior margin of the third abdominal segment there are no spinules. The first abdominal segment is short, partially concealed, with a median transverse ridge and with the lateral margins small, subacute, forward-directed. The second segment is longer, with two long transverse ridges across the entire segment, and a shorter, curved ridge anterior to these, forming the anterolateral border of the widely rounded lateral margin. The third abdominal segment has two transverse ridges, the anterior of which is the wider, and also a smaller ridge on the anterior margin of the narrow, acute lateral area. The fourth abdominal segment is also subacute laterally and has two transverse, ciliated ridges across the median area and a third, shorter ridge curving along the anterior lateral region near the margin. The fifth segment is usually ventral in position and is distinctly longer in the median line than the preceding segment and much narrowed on the anterior half, the postlateral angle being narrowly rounded; the sixth segment is narrower and a little shorter in the median line than the fifth and is marked by two transverse, curved ridges; the telson is little longer than the sixth segment, its posterior margin widely rounded, ciliated, weakly bilobed in the median line and cut by oblique lines on each half; the dorsal surface is marked by crescentic squamae outlined by short setae. The uropoda have the peduncle short, wide, strong; both blades are bluntly truncate, each a little shorter than the telson and with similarly ciliated margins; the outer blade is narrower than the inner blade, which is expanded on its rounded inner lateral margin.

The eyes are large, blackish, reniform.

The antennulae have the first article produced into a very long, acute spine at the outer lateral angle, this spine curved upward, extending for a considerable distance beyond the eye and reaching almost as far forward as the median rostral spine; the second article is narrow, cylindrical, reaching slightly beyond the eye and armed at the inner and outer distal angles, each with a spine; the remaining articles are broken off.

The antennae have the basal article widest and produced to a long acute spine at its inner distal angle; the second article is

slightly narrower and has a similar acute spine at each the inner and outer distal angles, that at the inner angle being slightly the longer, extending to midway the eye; the third article is small; the flagellum, represented by about sixty-three rings, appears to be broken off at this point; the portion present extends to midway the finger of the chelipeds.

The chelipeds are subequal, slender, about two and two-thirds times as long as the lateral margin of the carapace, covered with squamae on the upper surfaces, and with the anterior lateral margin of the merus, carpus and propodus armed with a series of acute spines; a single spine is situated on the lateral margin at the base of the upper finger; there is a longitudinal series of spines on the upper surface among the squamae. There is also a solitary spine on the upper distal margin of the merus and another at the outer distal angle. The fingers are subequal, slender, blade-like, each a little longer than the palm, the curved tips crossing and with two spinules subdistal to the tip on the outer margin of each finger.

The ambulatory legs successively decrease in length in the order 1, 2, 3, but are otherwise similar, slender, the posterior lateral margin of each the merus, carpus, propodus and proximal two-thirds of dactyl armed with a series of spinules; the tip of the dactyl is curved moderately, acute. The anterior lateral margins of these legs have a series of long fine setae.

The fifth pair of legs is typically small, slender, reflexed.

REMARKS: The present specimen conforms in major essentials with *M. andamanica* Alcock, from which it differs: (a) In possessing a small precervical spinule on either side on the third transverse beaded ridge. (b) In possessing two pairs of spinules, one of each pair being on each side, posterior to the cervical groove, where Dr. Alcock notes only one pair present. On the "Alva" specimen the second pair of spines are so fine that they could easily be mistaken for a hair, especially on a wet specimen. (c) The present specimen has definitely six spinules on the second abdominal segment, but also has an encrusting foreign calcareous growth which may and probably does conceal two more spinules beneath it.

The differences cited are too trivial to merit consideration, especially when it is remembered that the present specimen is very young. Hence, it is placed as variety *andamanica* Alcock.

- REFERENCES: *Munida militaris*, HENDERSON, J. R., Ann. Mag. Nat. Hist., ser. 5, vol. XVI, 1885, p. 410; Rept. Voy. H. M. S. "Challenger" Zool., vol. XXVII, Anomura, 1888, p. 137, pl. 14, figs. 2-5.—BENEDICT, J., Proc. U. S. Nat. Mus., vol. XXVI, 1906, p. 311.
- Munida vitiensis*, HENDERSON, J. R., Ann. Mag. Nat. Hist., ser. 5, vol. XVI, 1885, p. 410 (Henderson, *dixit*).
- Munida militaris* variety *andamanica*, ALCOCK, A., Ann. Mag. Nat. Hist., ser. 6, vol. 14, 1894, p. 321; Illus. of Zoology of "Investigator," Crust., pl. 13, fig. 2.
- Munida andamanica*, ALCOCK, A., Descrip. Cat. Indian Deep-Sea Crust. Decap. Macrura and Anomala. Revised Account "Investigator" Species. Calcutta, 1901, p. 242.

Genus: GALATHEA Fabricius

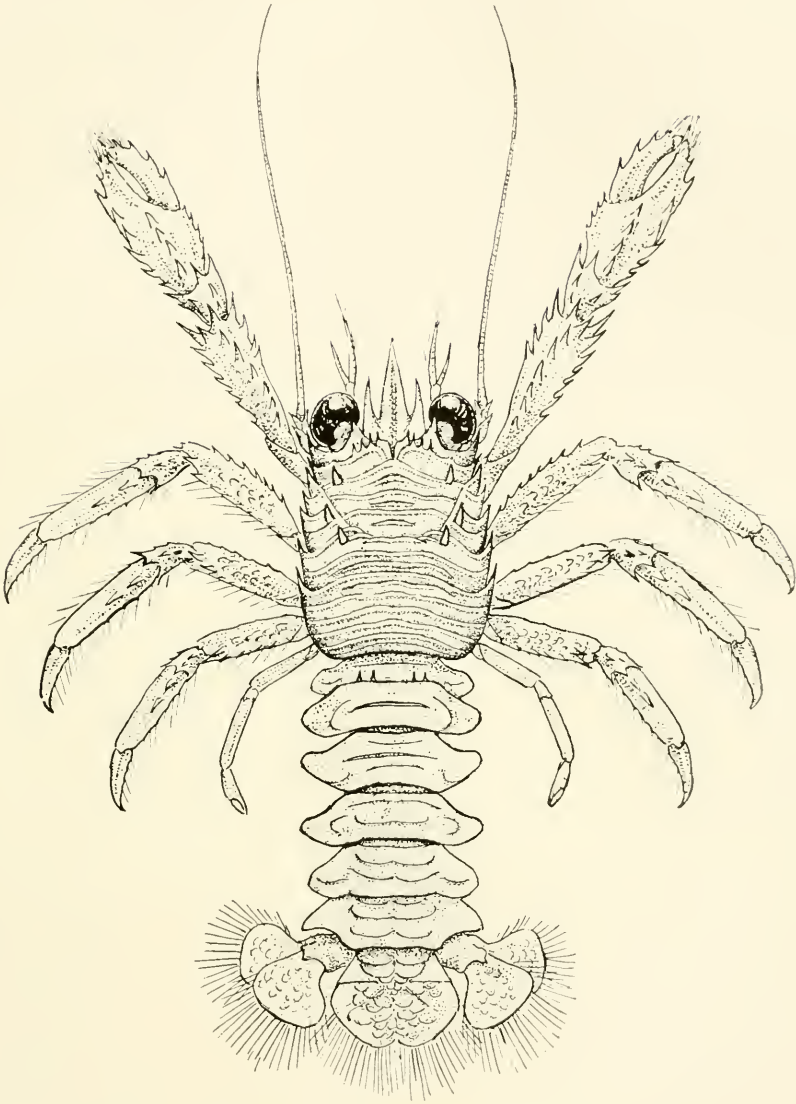
Galathea balica new species

Plate 11

TYPE: Two very young specimens collected in coral, Temukus Roads, Bali, Dutch East Indies, October 25, 1931, by the "Alva," form the type series, and are deposited in the Vanderbilt Marine Museum, Cat. No. 692.

DISTRIBUTION: So far restricted to the type series.

TECHNICAL DESCRIPTION: This exquisitely sculptured small *Galathea* reminds one of an ancient Cho-sun ivory. Front produced into a well developed rostrum, consisting of a strong, forward and upward directed median triangulate spine, dorsally keeled and extending beyond the orbit by about half the rostral length, and a pair of submedian rostral spines, each about three-fifths as long as the median spine; basally in line with it but well separated by a V-like excavation of dimensions equal to one of the spines and uptilted so that they are on a plane slightly above the median spine and directed outward and forward, the tip being slightly in advance of the distal border of the eye. Outside of this submedian pair of spines there is another pair of much smaller spines, one each side at the base of the larger spine, preorbital in position, slightly more elevated than the larger spine and very short, not extending as far forward as the base of the cornea. The carapace is decidedly convex from side to side with the lateral



Galathea balica, new species, $\times 4$.

margins moderately convergent anteriorly and less so posteriorly, with a strong, acute spine at the preorbital angle and a small spinule at the base of this outside, and with five sharp, outward and forward directed spines along each lateral margin, three of which are precervical and two postcervical, one each at the antero-lateral terminus of one of the transverse ridges that ornament the dorsal surface. The cervical groove is deep and there are five entire transverse ridges anterior to it, the first of which is sinuate and bears twelve acute teeth, six of which occur at the base of the rostrum; the outermost pair of the twelve teeth occur, one on each side, midway behind the orbital margin; the other four ridges are devoid of dorsal spines; the hinder three ridges are cut by the cervical groove. On the postcervical region there are seven complete transverse ridges and anteriorly, the lateral portions of the three ridges cut by the cervical groove. There is a small, sharp spine at the inner lateral angle of the third of the short ridges, adjacent to the cervical groove; immediately behind this spine is a second similar spine on the first complete postcervical groove. The *linea anomurica* is very distinct. On the lateral walls of the carapace there are several, four to six, oblique ridges running forward.

The first abdominal segment has a small tooth-like epimera. The second abdominal segment has two small, submedian spinules on each side in the median lateral region of the most anterior transverse ridge, which is sinuate laterally; there is a deep, median, transverse groove on this segment and a fainter transverse groove posteriorly and a still fainter transverse groove anteriorly, which is nearly obsolete in the median area and recurvate on the broadly rounded epimera. The third segment is smooth, except for two smooth transverse grooves; the anterior groove recurves laterally and extends onto the epimera; the posterior one curves backward and terminates above the epimera. The epimera are much narrower than those of the preceding segment and rounded. The fourth segment is a little longer in the median line than the third and has the epimera rounded and not quite so narrow; the dorsal surface is transversed by three lines, which terminate unequally above the epimera. The fifth segment is still longer medially and has two transverse grooves on the median segment and an incomplete less distinct groove posteriorly which extends on the epimera. The sixth abdominal segment is the longest of the series with the posterior margin truncate above the telson and excavate

above the base of the uropoda, with the epimera narrow, rounded and folding under those of the preceding segment; there is a shallow groove near the anterior margin, obsolete in the median region but forming curves on the epimeral region; there is a deep sinuate transverse groove in the median region and a similar one in mid-way between this and the posterior margin, neither of which extends to the lateral region. The telson has the distal margin broadly, rather bluntly rounded, bilobed by the median longitudinal sulcus; the lateral incisions are oblique. The proximal portion of the telson is triangulate with a proximal, interrupted, transverse ridge, followed by a similar but entire ridge, and just below the apex a pair of suboval squamae, followed by the similar contoured apex. The telsonic margins are ciliated.

The eye is large, ovoidal; the cornea black, bulbous; a sparse fringe of setae along the dorsal line of union between the stalk and cornea.

The antennae have the first peduncular article armed with a spinule at each distal angle; the second article is smaller with similar distal spines, weaker; the third article is about half as long as the second, devoid of distal spines; the flagellum is very fine.

The antennulae have the peduncular articles curiously modified to protect the orbit; the basal article is large and can only be seen in a ventral view with its outer distal angle produced in a long spine curved upward, its outer lateral margin denticulate, each denticulation carrying a long solitary hair, directed outward and laterally, protecting the eye. The tip of this spine is very acute, produced almost as far as the long submedian rostral spine; the second article is small, somewhat encupped on the outer side by the first article and has its inner distal angle produced to an acute tooth and the outer distal angle a long acute tooth that extends almost as far as the third article; the third and fourth articles are cylindrical, subequal; the flagellum is rudimentary with a hairy brush of setae.

The chelipeds are equal, each one being about twice as long as the lateral border of carapace, slender; the merus is dilated distally, armed with spines on both lateral and upper surfaces, these spines along the upper distal border being much longer and sharper than elsewhere; low, scale-like squamae are interspersed among the spines; the carpus is two-thirds as long as the merus,

similarly dilated and spinose; the propodus with the palm about as long as the carpus and two-thirds as high as long, not very swollen, the outer and upper surfaces covered with squamae and upper surface of the palm has additionally about five intermediate, longitudinal series of smaller spines; the dactyli are about as long as the palm, slender, curved distally, with a wide oval gape, the tips only meeting; the tip of the lower finger is tridentate and rugose; the upper finger-tip interfits into the lower one. The lower finger has a single basal molar with serrulate surface and the upper finger has a smaller basal molar followed by well-spaced spines, these spines tending to form a double longitudinal row along the upper surface and a single row of very long spines along the lower margin, this latter row continuing along the inferior margin of the lower finger; one or two rows of spines are present on the outer surface; the fingers are about as long as the palm, meeting throughout their length along the evenly denticulated outer margin, but somewhat separated by a concavity along the proximal portion; the tips are rounded, hollowed, and slightly crenulated, with a sieve-like brush of setae set subdistally along the outer margin of each finger. Numerous long, solitary setae occur on the meral, carpal, propodal and dactylar joints of the chelipeds.

The second, third and fourth pairs of legs are similar, but successively decrease in length from the first to third pairs, respectively; each leg has the merus slightly expanded, squamose on the dorsal surface and inferior lateral margin, the superior lateral margin with a longitudinal series of sharp spines; the carpus is about half as long as the merus with three acute spines on the superior lateral margin, the third spine being distal; a row of spinules on the upper surface, a single spine at the inner distal angle; the propodus is quite slender, about as long as the merus with one or two spinules proximally on the outer surface, the inferior lateral margin with five or six spines; the dactyl is two-thirds as long as the propodus, tapered, the inferior margin with five or six spines, the tips acute, curved.

The fifth pair of legs is slender, retracted within the branchial cavity.

Galathea latirostris Dana

Plate 12

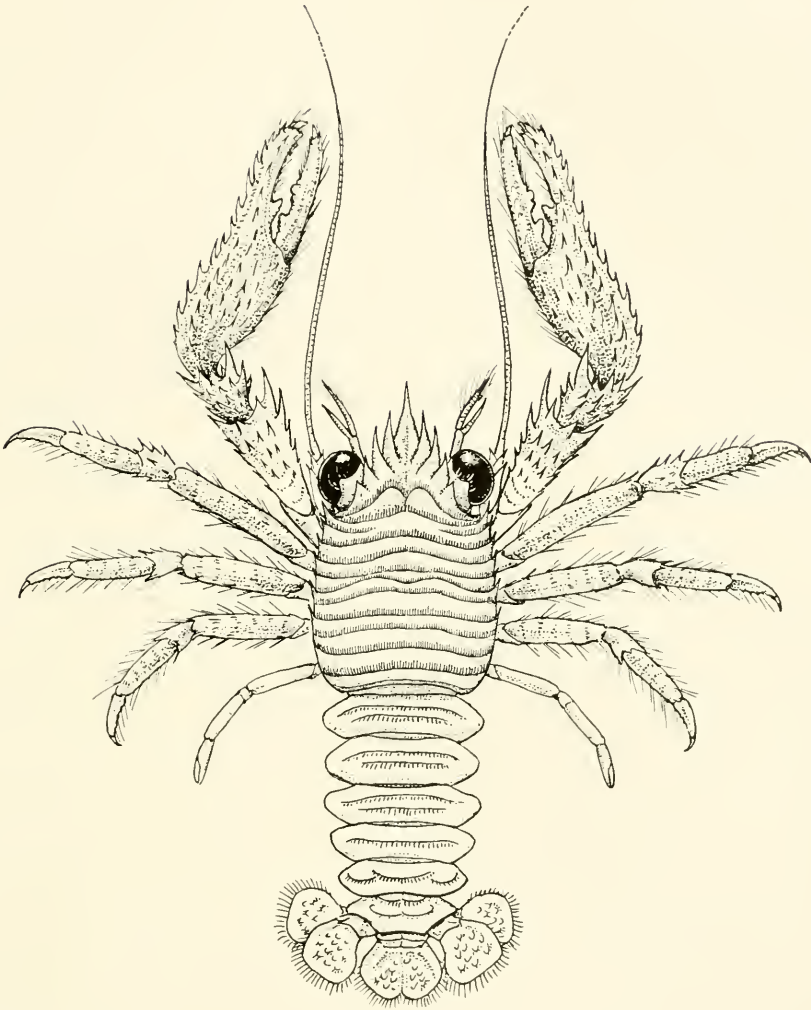
TYPE: Dana's type was collected in the Fiji Islands among corals and in cavities of coral rock.

DISTRIBUTION: The Fiji Islands, the type locality, is the only record cited for this species until its rediscovery by the "Alva" at the four widely separated localities cited below.

MATERIAL EXAMINED: One small specimen, taken in coral, Ingram Island, Queensland, Australia, August 12, 1931. One slightly larger specimen taken at Pago Pago, Samoa, U. S. A., September 2, 1931. Seven, some of which are very small, taken on Venus Point Reef, Tahiti, Society Islands, August 15, 1931. One taken in coral, Teviatea Reef, Raiatea Island, Society Islands, August 21, 1931.

TECHNICAL DESCRIPTION: All ten specimens in the series are quite young.

The front is produced to a triangular rostrum, extending beyond the orbit and consisting of a median, apical triangular spine, forward-directed and slightly uptilted distally, and on each side of this a series of four serrate distal spines, the distal pair of which are the longest, extending slightly in advance of the eye and being triangulate and more uptilted than the median spine; the second pair of lateral rostral spines are two-thirds as long as the distal pair, triangulate, directed obliquely outward above the base of the eye; the third and fourth pairs of spines are successively smaller, situated above the eyestalk. The dorsal surface of the rostral area is smooth in these young specimens and slightly concave in the median area. There is no branchiostegal spine; the outer orbital angle is a small spine. The carapace is 3.5 mm. long, from posterior margin to base of rostrum, 3.1 mm. greatest width, which occurs slightly in advance of the posterior margin. The rostrum is 1.5 mm. long. The carapace is decidedly convex from side to side and has a suboval contour, the lateral margins converging toward each end, but more so anteriorly. There are eight acute, procurved spines along the lateral margin, four along the precervical portion and four on the postcervical portion. The cervical groove is deep; the precervical portion of the carapace is ornamented with four uninterrupted, transverse ridges ex-



Galathea latirostris Dana, $\times 4$.

tending from margin to margin, where each bears one of the lateral spines; each ridge is microscopically granulated and fringed anteriorly with fine, short, amber setae; a fifth, short, incomplete ridge occurs across the rostral base. There are about six similar complete ridges on the postcervical region. The *linea anomurica* is distinct in the young specimen. The lower lateral wall of the carapace is ornamented with three oblique ridges that curve forward and also a row of four or five denticles below the eye.

The abdominal segments are devoid of spines in these young specimens; the second, third and fourth segments each have their anterior margins fringed with fine setae; and each has a transverse ridge, also setae-fringed anteriorly; the fifth and sixth segments have only very faint transverse lines and are quite glabrous; the telson has the posterior margin broadly rounded, evenly bilobate; there is a median longitudinal groove and the posterior suture lines are oblique; there are a pair of squamae-like arcs edged with fine setae, proximally, faintly delineated on the translucent telson. The uropoda are large, fan-like, the peduncle wide with an acute tooth at the upper inner posterior angle; the inner blade is the larger, with the distal margin unevenly truncate, slightly rounded; the outer blade is slightly smaller and more regularly rounded distally. On the dorsal surface of the large blade there are several arcs of minute setae emphasizing the posterior border of half-circle squamae-like formations which in older specimens probably become definite squamae. The telson and rhipidura both have the distal margins heavily fringed with long, web-like setae.

The eye is large, bulbous, with a short, thick stalk and hemispherical cornea, set obliquely terminal, so that its lower frontolateral surface is much greater than the dorsal.

The antennulae extend beyond the rostrum a short distance and have the peduncular joints enlarged, the distal peduncular article produced at the outer distal angle into a strong spine that protects the orbit; and has also a slenderer long, median distal spine and another spine subequal to it at the inner inferior distal angle; the flagellum is short, slender, tufted with setae distally, usually concealed on the inner side of the peduncle but when extended reaching a little beyond the rostrum.

The antennal peduncle has only the distal two articles visible dorsally; these are successively smaller, each about as wide as

long and with a small distal spine at both the inner and outer lateral angles; the flagellum is thread-like, composed of forty-five to fifty rings, each bearing a tactile setum at its outer margin, the whole exceeding the chelipeds in length by almost the length of the dactyli.

The chelipeds are subequal, about 10 millimeters long, or slightly longer than the body; the ischial joint is strong, terminating in an acute tooth at the lower distal angle; the merus is dilated distally with the lower surface granulose and the upper surface spinose; a particularly long spine occurs at the inner distal angle; the carpus is two-thirds as long as the merus, dorsally rounded and with four approximately longitudinal series of spines, the outermost of which are lateral; there is a long acute spine at the inner carpal angle; the propodus has the palm only a trifle longer than the carpus, dorso-ventrally flattened, slightly wider than the carpus, with both lateral margins spinose with coarse, sharp spines, the lateral series continuous along the outer margins of the dactyli, and especially strong on the lower dactyl. The lower dactyl has a single large tooth and the upper dactyl has large, bifid tooth. Abundant long, solitary setae occur on the inner dactylar margins, forming a crude sieve. The upper, and especially the lateral, surfaces of the carpus, propodus and dactyl are also set with numerous long, solitary setae. In the females the chelipeds have the gape less wide but constant.

The ambulatories are slender, the first pair not quite extending to the base of the dactyl of the cheliped, and the second and third pairs of legs successively decreasing in length by approximately the length of the dactyl of the preceding pair. Each leg has the merus elongate, compressed cylindrical, banded by transverse ridges and with the lower, and especially the upper, lateral margins spinose; the carpus is about one-half as long as the merus, dilated distally and similarly spinose along the lateral margins; the propodus is slenderer, more compressed, about twice as long as the carpus, with the upper margin spinose; the dactyl is little over half as long as the propodus, with a strong curved tip, augmented by a subdistal spinule on the inferior margin. The carpus, propodus and dactyl have numerous long, solitary setae on the upper surface.

The fifth pair of legs are slender, smooth, reflexed.

REMARKS: On the Samoan specimen, which is about one or two moults larger than the other nine specimens, the five transverse ridges of the precervical region of the carapace are replaced by a series of interrupted rugae, formed of small squamae-like arcs, with the convex margin anterior and fringed with fine setae.

REFERENCES: *Galathea latirostris*, DANA, J., U. S. Explor. Exped. Crust., vol. XIII, pt. 1, 1852, p. 480; Atlas, 1855, pl. 30, fig. 8.—BENEDICT, J. E., Proc. U. S. Nat. Mus., vol. XXVI, 1903, p. 302.

Family: PORCELLANIDAE

Genus: PETROLISTHES Stimpson

Petrolisthes armatus (Gibbes)

DISCUSSION: For full description and figure of this species, consult Bulletin of the Vanderbilt Marine Museum, vol. III, 1930, p. 73, pl. 19.

MATERIAL EXAMINED: Forty-two specimens, taken on the reef at Apia, Samoa, September 5, 1931. One male specimen, Falcon Island, Palm Islands, Queensland, October 7, 1931.

DISTRIBUTION: This species is practically tropicopolitan in the tidal zone of the Indo-Pacific and of the west coast of America from Lower California to Peru, including the Galapagos Archipelago. It is also found throughout the West Indian region and eastward in the tropic Atlantic on the west coast of Africa.

The Samoan specimens show quite interesting degrees of variation among the forty-two specimens. The majority have the carpus of typical length and armed with three teeth on the anterior margin, but five specimens have the carpus of normal length armed with three teeth on one side, but with four equally developed teeth on the carpus of the opposite cheliped. One specimen has the carpus greatly foreshortened, less than half the normal length, but armed with three teeth. Five specimens have the anterior margin of one carpal joint armed with coarse serrations, slightly smaller than the three teeth, among which these serrations are interspersed. There is also considerable variation in the degree of corrugations or rugae on the carpus and legs. This varies from normal to a few excessively rough surfaces on a few individuals, to some that are almost entirely smooth. One such specimen also has the hepatic tooth missing on one side, but present on the opposite side.

MACRURA

Family: **SCYLLARIDAE**

Genus: **PARRIBACUS** Dana

Parribacus ursus-major (Herbst)

Plate 13

TYPE: Herbst's type came from the East Indies and is deposited in the Berlin Zoological Museum.

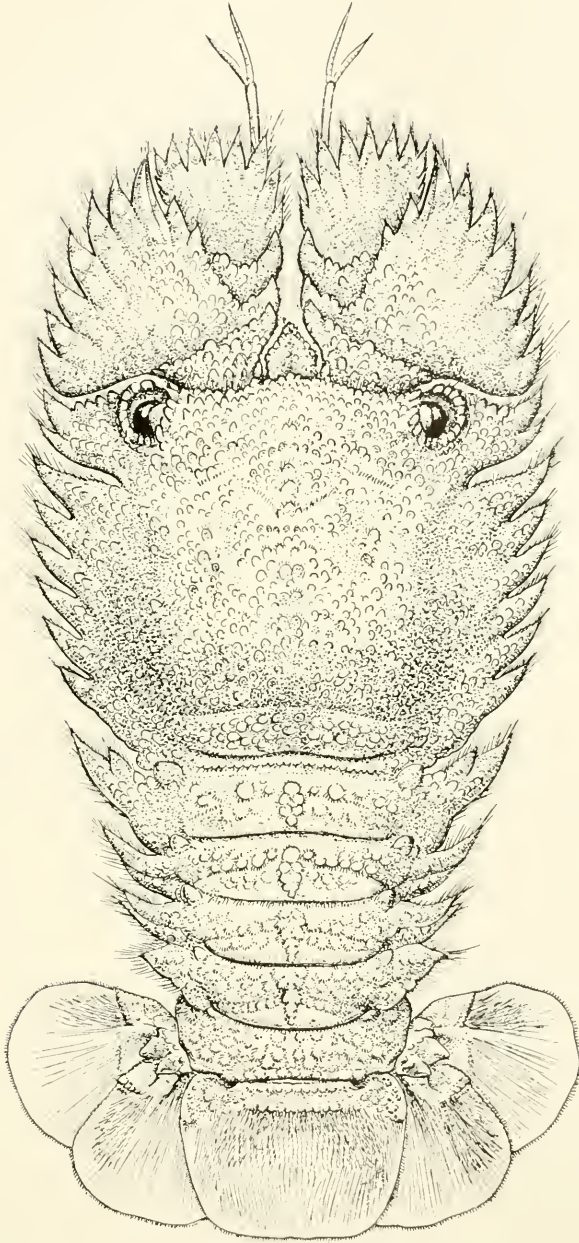
Lund did not cite a type locality in his original description of *Scyllarus antarticus*, but referred to Seba's figure, "Seba Muf., tab. 20, fig. 1." The majority of Lund's types are deposited in the Copenhagen Museum.

DISTRIBUTION: This species, which was known to the earliest writers on natural history, is found in widely separated areas of the Indo-Pacific, from Mauritius eastward to the Paumotu Archipelago and from Japan to the Hawaiian Islands. It is not yet reported from the Red Sea. It has been reported from the tropic west Atlantic, on the shores of Brazil and in the Caribbean.

It is recorded from the following stations: Mauritius, Reunion Island, Indian Archipelago, Amboina, Ternate, Australia (Nobili); New Guinea (Miers); "Siboga" Station 131, anchorage off Beo, Karakelang Islands, 13 meters (de Man); Sagami Bay, Japan (de Man); Natikitiwan, Lifu, Loyalty Islands (Borradale); Funafuti, Ellice Islands (Whitelegge); Upolu, Samoa (Dana); Palmyra Island (Edmondson); Hawaiian Islands (Randall, Stimpson, Rathbun); Carysfort Island, Tahiti, Society Islands (Nobili); Papeete, Tahiti (Boone); Rikitea, Hao Island, Paumotu Islands (Nobili); Coasts of Brazil (Marcgraf).

MATERIAL EXAMINED: One large specimen from Venus Point Reef, Tahiti, Society Islands, August 15, 1931. Another specimen from Papeete, Tahiti, August 16, 1931.

TECHNICAL DESCRIPTION: Carapace squarish appearing but in reality not quite three-fifths as long as wide, with the frontal margin truncate; the lateral margins are subparallel, cut into eight strong, acute, procurved teeth, of these teeth the first and second are semicoalescent, while the incision between the second and third teeth is two and one-half times as deep as, and wider than, any of the others, extending inward to a point opposite the orbital outer margin; there is a bunch of coarse setae on the an-



Parribacus ursus-major (Herbst.), about two-thirds of natural size.

terior margin of each spine. The dorsal surface is decidedly elevated in the median region, moderately convex and sloping gradually toward either side and toward the front. The entire dorsal surface is covered with coarse, low, convex squamae, each of which has the anterior margin rounded and margined by fine short setae. There is approximately a median longitudinal line of these squamae which are larger than the others; there are also a few other large squamae scattered on the median area; towards the front and sides the squamae become much smaller. The orbital margin is circular and beaded with squamae.

The eyes are set upon short, stocky, calcareous-covered stalks and have large, hemispherical, black cornea.

The rostral segment is shield-shaped with pointed apex; the dorsal surface covered by small squamae.

The antennulae are slender, arising side by side beneath the base of the rostral joint; the first article is much the stoutest and clavate, laterally compressed, distally tapered, with one small spinule on the upper distal margin; the second and third articles are subequal in length to the first but are successively slenderer; the flagellum is rudimentary, two-branched, each branch less than the third article in length; the larger branch bears a small tuft of setae.

The antennae have the basal article wider than long, obliquely truncated, extending from the outer orbital margin to the apex of the rostrum; the inner lateral margins of the antennal joints surround the rostrum. The distal margin of each antennal joint is a sharp tooth; the second antennal joint is greatly expanded, laminate, with the outer lateral margin a little rounded and cut into eight acute procurved teeth, which are in line with those of the lateral border of the carapace and successively increase in size from the proximal to the distal one; across the irregular distal margin of this segment there are two sharp teeth, successively smaller, just inside of the outer distal tooth, there are four or five sharp denticles and a very strong sharp tooth at the inner distal angle; the third article is the smallest of the series, stout, with a very strong, acute spine at the inner distal angle and four or five denticles along the brief distal margin; the fourth antennal article is widely expanded with the margin rounded and cut into nine acute, triangulate teeth, the smallest of these being the inner proximal one. The first three antennal articles are covered with

squamae on the dorsal surface but there are only a few small ones on the proximal portion of the fourth article.

The abdomen consists of seven segments, of which the sixth and seventh are usually reflexed, *Galatheid*-like. The first abdominal segment is short and much narrower than the second segment, fitting in the median posterior margin of the carapace and having the lateral, or epimeral region, represented only by one short spine at the postlateral angle. The dorsal surface of this segment is covered anteriorly by about three rows of squamae, margined posteriorly by a deep groove, which sets it apart from the rounded, carinate and posteriorly setose, posterior margin of the segment which bears at its extreme distal angle the lateral small tooth. The second segment is the widest of the series, with the lateral region produced into a strong, procurved spine, which has a small tooth on the anterior side of the base of the larger one and on the posterior side of the base there is a wide, ventrally directed, truncate process; behind and above which, at the dorsal posterior angle, is a small denticle. There is a strong, node-like, median dorsal tooth with the apex directed forward; a curved transverse groove separates the more squamose anterior portion of the segment from the posterior portion. The third segment is like the second but less wide, with a more acute, large lateral tooth which differs in having no smaller tooth at its anterior base but does have on the posterior side a ventrally directed tooth and behind this a denticle; there are two transverse grooves on this segment, one setting apart the small anterior portion, which glides beneath the preceding segment, and a second groove that extends from opposite the median nodule to the posterior base of the large epimeral tooth. The fourth segment is less wide, with a shorter though strong lateral tooth, and with the median nodule greatly reduced and directed posteriorly. The fifth segment is a trifle longer in the median line than the fourth segment but less wide, with only one stout, triangulate, lateral tooth and two transverse grooves. The sixth segment is only two-thirds as long as the fifth segment and much narrower, obliquely truncated laterally above the base of the uropoda. The telson is almost twice as long as the preceding segment, wider proximally than distally, with the lateral and distal margins bluntly rounded; the proximal third of the telson is hard, finely squamose; the distal two-thirds is softer, leathery, longitudinally striated; on the proximal two-

thirds of this striated region there are also fine setae. The uropod peduncle is small, calcareous, with three distal denticles, the median of which is the larger. The outer and inner blades are subequal, lobate, broadly rounded, almost truncate distally, with the proximal portion calcareous, the distal soft and striated like that of the telson.

The five pairs of legs are monodactyl, nearly equal, slender, laterally compressed, with strong curved dactyli. The fifth pair of legs differs from the preceding pairs in that the ischial joint has a strong acute spine at the hinder distal angle and has the paired male orifices in the ventral surface of the coxal joints.

The sternal plastron is a narrowed shield with a deep transverse pit or sulcus between the bases of the fourth and fifth pairs of legs and with a small median nodule in the median line between the bases of the fourth and third pairs of legs, also a similar nodule between the second and third pairs of legs.

COLOUR: The living specimen has been described as "yellow or smoky yellow clouded with smoky brown, and some spots of carmine; around the eye, carmine. Last abdominal segment, deep ochre-yellow and short hirsute." (Dana).

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Genus: THENUS Leach

Thenus orientalis Leach

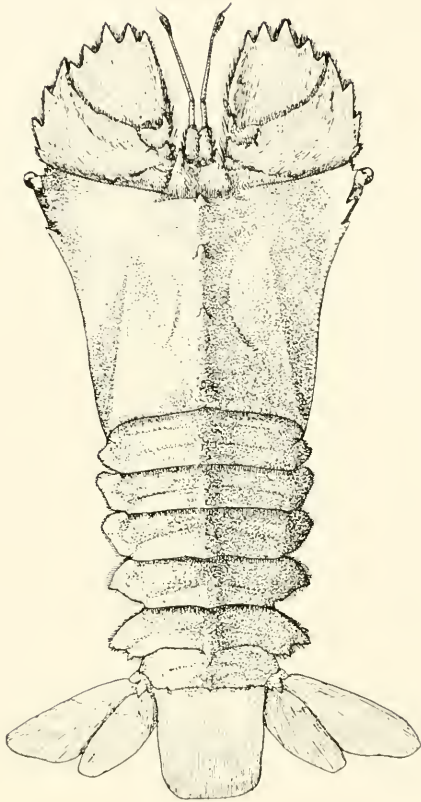
Plates 14 and 15

TYPE: Rumphius' type came from Amboina and was deposited in his private cabinet. Lund cited the East Indies and China as the type locality in his description, which was based on material in the collections of the Copenhagen Museum.

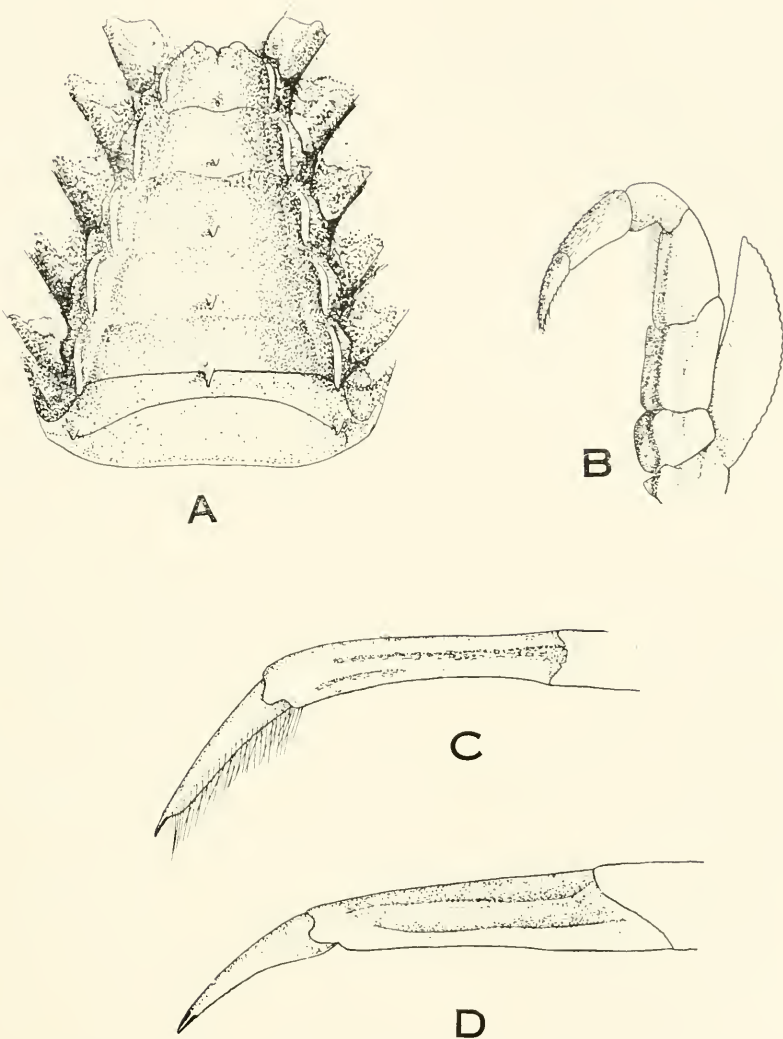
DISTRIBUTION: This species has a wide distribution, having been recorded from the Red Sea, eastward through the Persian Gulf, the Indian Ocean, Malaysia and Australia, down to Madagascar and Natal, South Africa, in depths varying from shallow water to 55 fathoms deep. The following localities have been cited: Red Sea (de Man); Massaouah (Nobili); Persian Gulf, Stations 39 and 56 (Nobili, de Man); Madras and south Indian coast generally (Henderson); Pescadores Island (Balss); Mergui Seas, Amboina (de Man); Indian Ocean, India, Cebu, P. I., Singapore (Ortmann); Singapore (Nobili, Boone); Kelatan, Trengganu, Lanchester, West Borneo (Miers); Arafura Sea, south of New Guinea, "Challenger," Station 188, depth 28 fathoms (Bate); Broome, Australia, 18 fathoms (Balss); Kermadec Islands (Chilton); Saya de Mahla Bank, Seychelles Islands, 55 fathoms (Borradaile); Madagascar (Hoffman); Amatikulu River, N. W. by W., $\frac{1}{2}$ W. 12 miles, Natal, South Africa, 26 fathoms (Stebbing).

MATERIAL EXAMINED: One specimen, 190 mm. long, from Singapore, Malay States, November 10, 1931.

TECHNICAL DESCRIPTION: Specimen 190 mm. long, from apex of antennae to posterior margin of telson. Carapace 45 mm. wide from tip to tip of postorbital spines; 30 mm. wide across posterior margin; 24 mm. long in the median line. Carapace one



Thenus orientalis Leach, $\times 1.5$.



Thenus orientalis Leach: A, sternal plastron, $\times 2.5$; B, external maxilliped, $\times 5$; C, first leg, showing dactyl and propodus, $\times 5$; D, fifth leg, showing dactyl and propodus, $\times 5$.

and one-half times as wide anteriorly as long and slightly more than twice as wide anteriorly as posteriorly, with the frontal margin slightly arcuate, the orbit anterolateral in position, the true preorbital angle a solitary acute tooth directed laterally; the supraorbital border is a conspicuously upcurved bifid tooth anteriorly from which there runs backward a carinate beaded ridge, interrupted by a second tooth, which is also carinate posteriorly to a point opposite the base of the posterior tooth of the lateral margin. The postorbital tooth is acute, stout, and inside of it there is a smaller denticle or blunted low tooth on the outer half of the orbital margin. There is a strong acute tooth on the lateral margin, which is about opposite the termination of the ridge and also opposite the anterior end of the oblique median lateral beaded line which extends from this point obliquely outward and terminates on the posterior margin of the carapace. This line is composed of solitary, rounded, pearly granules, similar to those found along the frontal and lateral margins. The median dorsal line of the carapace and first six abdominal segments is elevated into a prominent ridge, which on the carapace consists of three acute upward pointing teeth, the most anterior rostral one being the smallest, situated just behind, but overhanging the frontal margin and with the carina behind the tooth not pronounced; the second or gastric tooth, which is approximately opposite the lateral tooth, is larger and more elevated than the first tooth and has its posterior carina more pronounced; the third tooth, which is slightly posterior to the middle of the carapace and is postcervical or epicardiac, represents the apex of height of this median crest and is continued posteriorly as a beaded ridge, interrupted by a double low tubercle, suggestive of a rudimentary tooth, situated on the intestinal area just anterior to the posterior margin of carapace. The cervical groove is shallowly but distinctly delineated, curving outward and terminating anterior to the hepatic tooth. In addition to the above described lines of large, low, rounded tubercles, there are scattered over the entire dorsal surface of the carapace numerous, solitary, low, flattish, circular squamae which stand out in bas-relief among the furry coating, which is composed of fine, short pilosity forward-directed and more abundant and longer on the frontal and orbital margins and hepatic regions. The median rostral process is small. The true rostral process is composed of a small, acute median point or tooth, semiconcealed

beneath pilosity, situated at the proximal end of the median channel which lies between the large paired, triangular teeth, with apices uptilted, which are well separated by a deep, V-shaped sinus.

The basal antennal joint is visible dorsally as a small, nearly right-angled triangle, adjacent on either side to the rostral process; with the anterior angle of this joint a blunt tooth and another blunt tubercle conspicuous midway on the oblique frontal margin; the second antennal joint is expanded, with four acute teeth successively decreasing in size from distal to proximal along the anterolateral margin, the distal tooth being very long, acute, with a pronounced median dorsal carina; the second, third and fourth teeth each have an acute, procurved, horny tip; the third antennal article is also laminate with two acute teeth on the proximal part of the inner lateral margin, these teeth being semi-erect and procurved, the proximal tooth the smaller one and emphasized by a large blunt tubercle inside of it on the dorsal surface in line with that on the margin of the first article; there are eight triangulate teeth along the distal margin of this article, the outer three or four of these frequently being concealed beneath the great tooth of the second article. The dorsal surface of the antennae are pilose, especially along the margins of the joints and the distal margin between the teeth. The antennae are well separated throughout their length by a distance equal to the width of the rostral process.

The antennulae arise beneath the rostral process, the thick, pilose, cylindrical, basal joint extending as far as the base of the third antennal article; the second antennular joint is much slenderer, cylindrical but stout, one and one-fourth times as long as the first article; the third article is similar but slightly slenderer, only three-fourths as long as the second; the flagellum is rudimentary, consisting of two thick branches, the outer, larger one being one-half as long as the third article and setose; the inner branch is three-fourths as long as the outer branch; both are thick for the proximal two-thirds of their length and compressed laterally, the respective distal thirds being abruptly slenderer; the inner branch has a brush of setae on its inferior surface.

The eye is set out on the extreme anterolateral angle, which is excavate on the inferior surface by a deep semioval and on the upper surface of carapace has the exposed semihooded excavation previously described; the stalk is slender, cylindrical, calcareous;

the cornea is hemispherical, terminal, scarcely larger than the stalk, with excellent visual range.

The abdominal terga, one to six, inclusive, are elevated to a median longitudinal carina, on the first segment being less accentuated than those of the second, third and fourth segments, which increase in strength in the order named, while that of the fifth segment is posteriorly produced into an acute spine overhanging the sixth segment; the latter has the anterior half of the carina replaced by a faint sulcus beneath the spine, while on the posterior half there are a pair of submedian, blunt tubercles, followed on the posterior margin by a big, blunt tubercle that makes a prominent peak on the posterior margin. Each segment has a transverse depression across its anterior border, and also an arcuate, transverse sulcus submedially. The remaining elevated portion of the surface is ornamented by numerous, large, low, rounded tubercles, which tend to form transverse lines of beads along the margins and across the median zone of the respective segments. The epimeral border of the first segment is terminated in a small, acute, procurved tooth, that of the second, third, and fourth segments each in a downward, outward directed tooth, while the fifth segment has two backward pointed, procurved teeth on each side, separated by a concavity; the inner tooth being opposite the outer angle of the peduncle of uropod. The telson is as long as wide with the distal margin broadly rounded, the proximal portion soft but thicker than the more flexible distal portion. The uropoda is similarly flexible, expanding laterally; the peduncle is small with an acute tooth above the base of the inner blade. Both blades have each a pattern of longitudinal grooving with the addition on the proximal area of a few flat, oblique carinae.

The sternal plastron is of the shape figured (Plate 15, A), the anterior end being greatly narrowed and bounded by a moderately incised double tooth-like ridge and on either side the lateral margin is similarly up-bent, rim-like, thickened and terminating posteriorly on each segment in an acute tooth-like process. In addition to this there are on the median ventral line of segments one to five, inclusive, an acute, ventrally directed tooth, these increasing in size from the first to fifth segments. The first five abdominal segments have each a transverse, narrow, calcareous bar, which on segments one, two and three each has an acute median spine, on either side of which there is a series of coarse

tubercles of varying number.

There are four pairs of pleopoda, these successively decreasing in size in the order 1, 2, 3, 4; the first pair, when flexed inward, having its larger blade reaching scarcely two-thirds of the distance to the median line. Each pleopod consists of a small, stout peduncle, a large, ovate, outer blade and a distinctly smaller inner blade, which is scarcely two-thirds as long and less than half as wide, more lanceolate than ovate distally.

The external maxillipeds are as figured (Plate 15, fig. B).

The five pairs of legs are monodactylar, fragile, successively decreasing in the order 1 to 5. The dactyli of pairs 1, 2 and 3 are similar, very curved and pointed, claw-like, while the dactyli of pairs 4 and 5 are shorter and so appear less hooked, but each in reality has a stout horny nail-tip.

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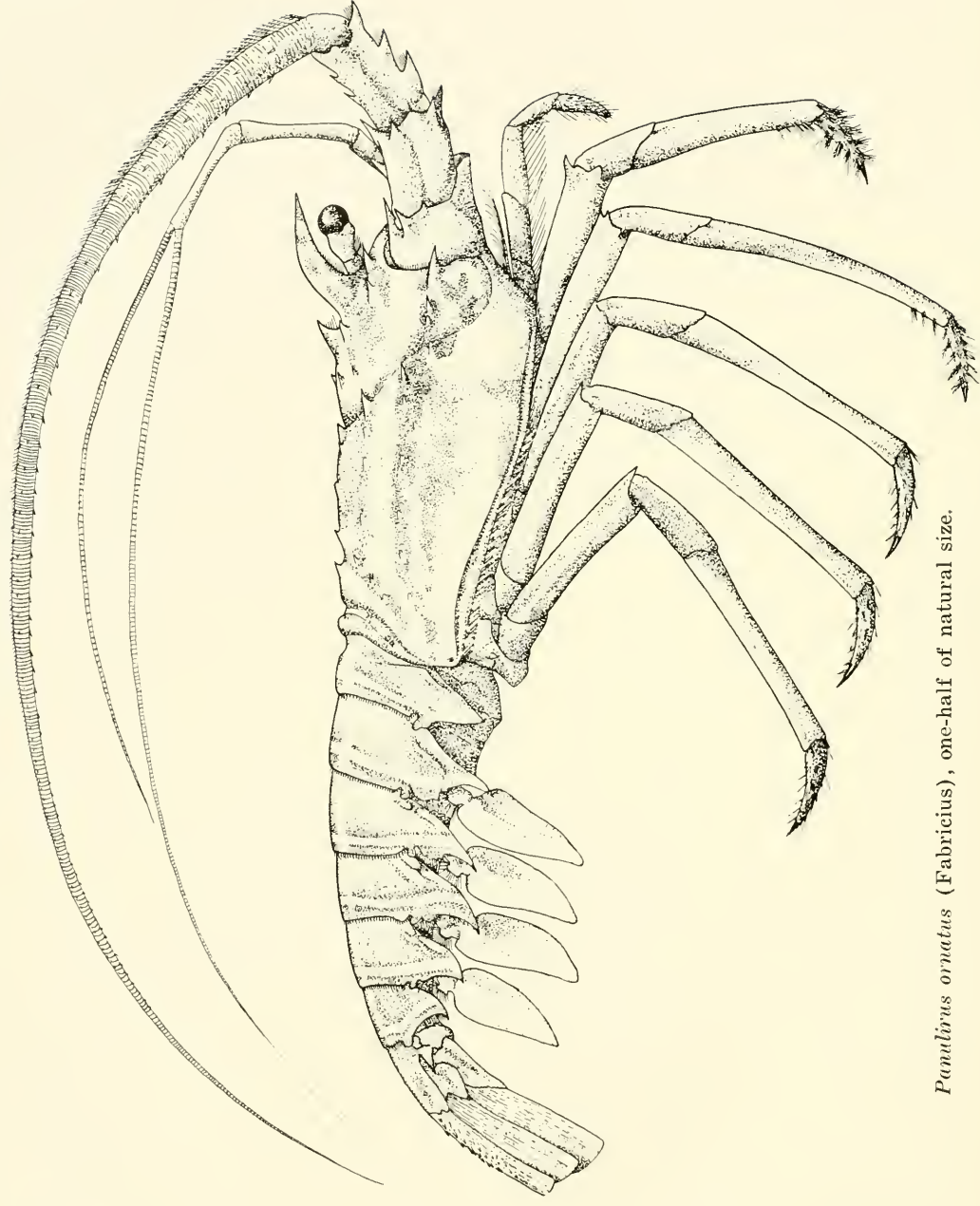
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Panulirus ornatus (Fabricius), one-half of natural size.

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Family: PALINURIDAE

Genus: PANULIRUS J. E. Gray

Panulirus ornatus (Fabricius)

Plate 16

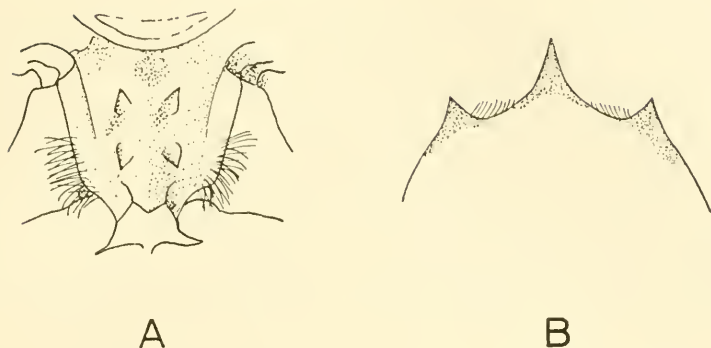
TYPE: Fabricius' type came from the Indian Ocean and, if still extant, is probably in the British Museum of Natural History.

DISTRIBUTION: This species is exclusively Indo-Pacific in its distribution, having been reliably recorded from the following places: Obock, Saint Augustine Bay, Nosse Bé, Madagascar (Gruvel); Madagascar (Bouvier); Zanzibar, Ile de France, seas of India (H. M. Edwards); Mozambique (Hilgendorf, Lenz and Richters, Hoffman); Reunion Island (Hoffman); Durban, S. Africa (Stebbing); Singapore (Walker); Tonkin, Cochin China (Miers, Hilgendorf, de Man, Gruvel); Nha-Trang, Annam, (Gruvel); Java (Heller); Singgora (Lanchester); Takao and Tamsu, S. Formosa, Making, Pescadores Island, Hankow, Amoy, Sumatra, Swatow, Herbertshöhe, Neu Pommern (Balss); Borneo (Miers); Amboina, Moluccas (Miers, Hilgendorf, de Man, Gruvel); Sorong, British New Guinea (de Man); New Guinea (Miers); north coasts of Australia (Miers, Haswell); 42 miles W. S. W. off Cape Jaubert, Australia (Balss); Samoa (Haswell); Tahiti, Society Islands (Boone).

MATERIAL EXAMINED: One large specimen from Venus Point Reef, Tahiti, August 15, 1931.

TECHNICAL DESCRIPTION: The carapace is three-fifths as wide as long, convex from side to side, with the postorbital horns strong, upstanding, procurved, projecting above and beyond the eyes; laterally compressed, acuminate, with a small strong acute pair of spines immediately behind the rostral spines. There is a small strong pair of spines near the frontal border and in line with the spines on the upper margin of the antennal peduncle, these represent the postorbital spine; a similar pair of spines, but placed on the frontal margin, represent the antennal spine. Behind each the rostral, postorbital and hepatic spines there are in approximate longitudinal series, rows of much smaller, acute, forward-directed spines, and interspersed between these, especially in the median postcervical area, there are other small spines or blunt tubercles. A series of small spines ornament the posterior border of the thorny portion of the carapace; immediately behind this area there is a deep, wide, smooth, curved groove, which in turn is bordered posteriorly by the flat, wide carina, with its anterior margin ridged and finely setose, that defines the posterior border of the carapace, and is continuous at its postlateral angles with a similar slightly narrower carina and groove that border the lateral margins of the carapace. The cervical groove is deep and wide, especially in the median dorsal line, and curves forward on the inferolateral area, terminating almost at the frontal margin behind the outer side of the antennal peduncle. The cardiac region is clearly defined, the urogastric sulcus being deeper and forming a deep sulcus on either side.

The orbital segment is thick, with the anterior margin convex, a median distal tuft of fine hairs on the upper margin. The stalk is heavily calcareous, maculated like the carapace, produced on the anterior lateral border into a denticle-like process, margined by short setae; just beyond this process the stalk is constricted near the base of the cornea and produced into a rounded calcareous process on the upper surface. The cornea is subspherical, large, with an excellent visual range in all directions. The rostral segment is large, being one-half as long as the precervical portion of the carapace, as wide proximally as long, with the outer margin widely convex, thickened; there are two pairs of submedian spines on the dorsal surface, the anterior pair being slightly the larger and placed practically on the margin; the second pair being a short distance behind these and anterior to the center of the segment.



Text figure 1—*Panulirus ornatus* (Fabricius), A, dorsal surface of rostral segment, showing two pairs of spines; B, anterior margin of sternal plate, showing the median spine, which is dorsally visible.

The antennulae arise immediately below the rostral segment and have the proximal article as long as the precervical portion of the carapace, slender, smooth, cylindrical, but curiously enlarged proximally; the second article is three-fourths as long as the first article; the third article is two-fifths as long as the second; the two-branched flagellum has the shorter branch one and one-third times as long as the peduncle with a fine brush of setae on the distal third; the longer branch is one and one-half times as long as the peduncle, slender, tapered.

The strong apical or median spine of the sternal plate is visible dorsally, projecting between the basis of the antennulae. This plate has, in addition to the median large spine, a smaller but strong submedian pair of spines, one each placed just outside of the antennular peduncle margin.

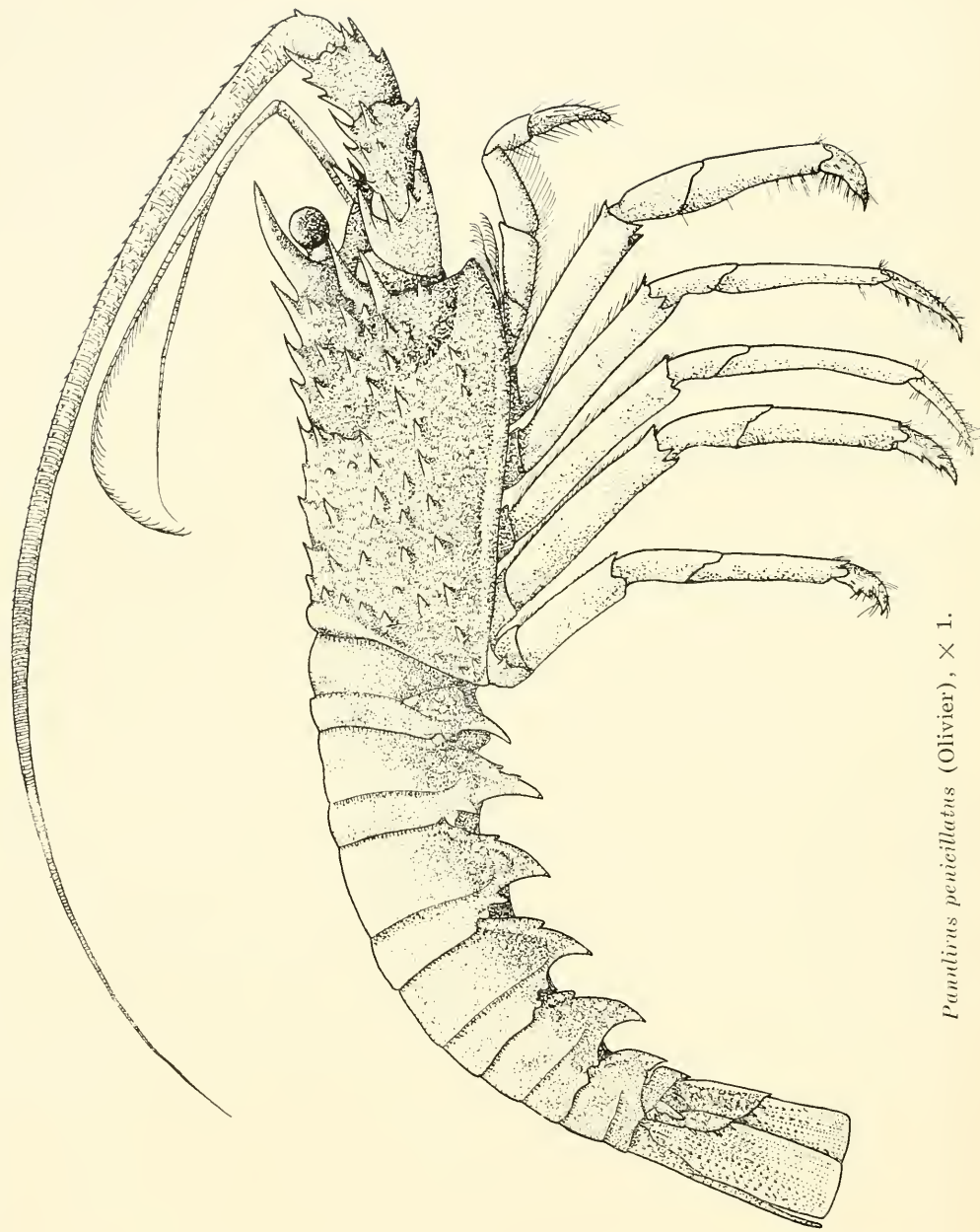
The antennae have the peduncle articles greatly developed, laterally compressed and armed along the anterior and posterior lateral margins, the distal margins of the respective segments and at other strategic points on the upper and lower surfaces with coarse, strong, out-jutting, acuminate spines. The flagellum is also strong, two and one-third times as long as the entire body, thick and ridged for the proximal half of its length, laterally compressed and armed with numerous sharp spinules set in longitudinal series, also with a fine short brush of setae on the outer lateral margin.

The abdominal segments are dorsally smooth, devoid of transverse grooves or carinae, except on the first segment, which has the normal division for articulation with the carapace. The epimeral margins of the first, second, third and fourth segments are very acuminate. The epimera of the first segment is acute, blunted distally and has a short, interrupted, transverse carina above the "button"; the epimera of the second segment are wider, very acute distally, with a deep groove just inside the anterior lateral margin, the postlateral margin convex and quadri-dentate on the proximal half, the distal half is smooth, tapered; the epimera of the third and fourth segments are similar to those of the second segment but with the anterior lateral groove successively shorter, the apex more definitely curved backward. This curvature increases in the epimera of the fifth segment and the groove is greatly reduced in the epimera of the sixth segment.

The five pairs of legs are similar, monodactyl, subcylindrical, laterally compressed, longitudinally striped in alternating cream and color markings; the merus has an acute small tooth at each the lower and upper subdistal margins; the dactyl is procurved with a strong horny tip, the inferolateral border, and also that of the distal propodal area are beset with numerous tufts of soft, short setae.

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Pandinus penicillatus (Olivier), $\times 1$.

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Panulirus penicillatus (Olivier)

Plate 17

TYPE: M. Olivier's type was collected in the Indian Ocean and is deposited in the Paris Museum.

DISTRIBUTION: This species has a wide distribution, being known from the Red Sea southward to the Cape of Good Hope and eastward to the Mariannes and the Hawaiian Archipelago. It has been recorded from the following localities: Red Sea (Nobili, Stimpson, Miers); Madagascar (Bouvier); Angulhas Banks, Cape of Good Hope (Stebbing); Reunion Island (Hoffman); Mauritius (Latreille, Richters); Egmont Atoll, Chagos Archipelago (Borradaile); Minikoi Island (Borradaile); Takao, S. Formosa (Balss); Mahonga Archipelago, Mariannes Islands (Gruvel); Sumatra (Gruvel); Rota Island, Agrigran Island, New Guinea (Pfeffer); North coast of Australia (Stimpson, Miers); New Caledonia (Gruvel); New Hebrides (Bate, B. M. Coll.); Hawaiian Islands (Gruvel); Fiji Archipelago (Bate); Papeete,

Tahiti, Society Islands (Bate) ; Venus Point Reef, Tahiti (Boone) ; Hao Island, Paumotu Archipelago (Nobili) ; Gambier Island (Gruvel).

MATERIAL EXAMINED: Four young specimens, from Venus Point Reef, Tahiti, Society Islands, August 15, 1931.

TECHNICAL DESCRIPTION: The eyes are large, spherical and afford only generic characters.

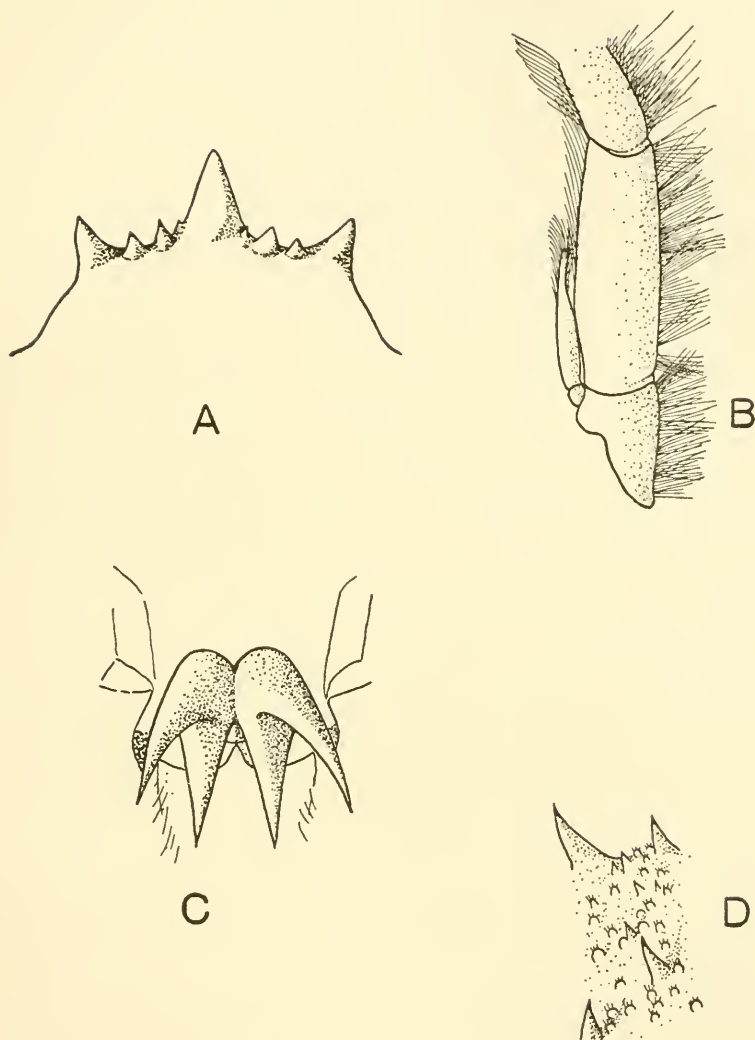
The third pair of maxillipeds have a distinctive, short, tri-angulate exopod.

The legs are monodactyl and possess no specific characters, except that the female has the fifth pair of legs modified. The distal end of the propodus is produced at the inferior distal angle into an oblique triangular process and immediately opposed to it on the proximal outer lateral margin of the related dactyl there is a similar obliquely placed acuminate triangle.

The abdominal segments bear the important specific character of possessing each a transverse groove that extends entirely across the respective segment, terminating on either side near the base of the epimera.

The first pair of epimera is very acute, the second to fifth pairs of epimera, inclusive, are also acute, and consist of the strong curved tooth, formed by the production of the anterior margin ; the second, third and fourth teeth of the second, third and fourth epimera each has a denticle on the anterior margin, the posterior margins of these teeth is each distinctly concave and terminates on the postlateral angle in a small acute tooth ; the sixth epimeral tooth is closely applied to the base of the uropoda. Each of the epimera has a sharp oblique groove which arises near the interlocking "button" of the segment and extends down near the anterior border of the segment and thence curves backward almost, but not quite, reaching the concave margin. The proximal portions of the telson and uropoda are calcareous, this area of the telson being definitely patterned and ornamented with a few denticles ; the distal portion of the rhipidura is flexible, membranaceous, and ornamented by fine longitudinal grooving.

This species is one of the most gloriously colored and highly ornamented members of the genus. The pair of rostral horns are strongly procurved, extending above and beyond the eyes. The postorbital and antennal spines are strong and forward protru-



Text figure 2—*Panulirus penicillatus* (Olivier): A, anterior margin of epistome, showing the distinctive dentition; B, section of external maxilliped, showing the distinctive exopod; C, the four strong spines that cluster on the rostral segment; D, detail of pattern of carapace; all, $\times 4$.

berant. The cervical groove is very deep; the hepatic and urogastric grooves are fainter but distinct. The entire surface of the carapace is highly ornamented, with five pairs of regularly spaced longitudinal series of small, forward-directed spines, which are also approximately opposite if viewed in transverse series; three and the median half of the row being precervical in position, while the lateral half of the fourth row and five additional rows are post-cervical. The interstices between the spines, which themselves decrease in size toward the hinder margin, are regularly paved with low flattish semicircular tubercles, each of which has the anterior margin rounded and closely adjacent thereto are three small divergent spinules or bristles.

The precervical segment is squarish with a protruberant cluster of four strong spines, the lower and slightly shorter pair being placed submedian on the anterior margin, while the second pair are immediately behind the first pair with their bases contiguous. These four spines are in line transversely with the distal marginal spines of the first peduncular joint of the antennae; the second and third peduncular articles of the antennae are similarly multi-spinose.

The antennulae are typical of the genus.

The epistome (text fig. 2A) is produced anteriorly to an acute median tooth, separated on either side by a concave, finely bidenticed marginal space from the submedian pair of teeth which are subequal in size to the large median tooth; beyond the submedian pair of teeth the margin recedes obliquely backward.

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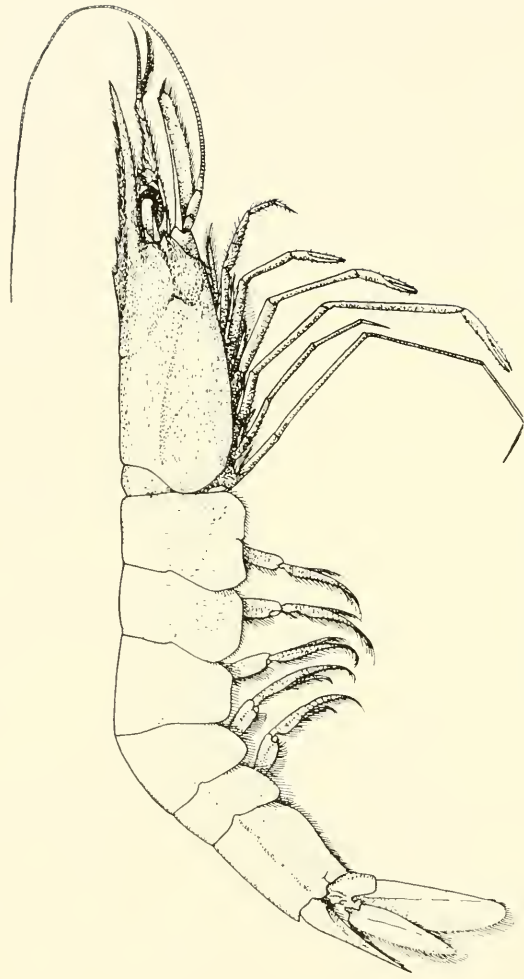
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Penaeopsis monoceros (Fabricius), $\times 1.5$

Panulirus penicillatus, DANA, J. D., U. S. Explor. Exped. Crust., XIII, pt. I, 1852, p. 519.—STIMPSON, W., Proc. Phila. Acad. Nat. Sci., vol. XII, 1860, p. 24.—BATE, C. S., Rept. Voy. H. M. S. "Challenger," Zool., vol. XXIV, 1888, p. 82, pl. 12, fig. 2.—BORRADAILE, L. A., Proc. Zool. Soc. London, 1898, p. 1014; in Dr. Willey's Zool. Results to South Seas, pt. IV, 1900, p. 419; Faun. and Geogr. Maldive and Laccadive Arch., vol. II, pt. 3, 1901-03, p. 754.—HENDERSON, J. R., Trans. Linn. Soc. Zool. London, ser. 2, vol. V, 1888-94, p. 433.—NOBILI, G., Ann. Sci. Nat. Zool. Paris, ser. 9, t. IV, 1906, p. 88; Mem. Torino R. Accad. Sci., ser. 2, t. LVII, 1907, p. 366.—BORRADAILE, L. A., Trans. Linn. Soc. London Zool., ser. 2, vol. XIII, 1909-10, p. 260.—GRUVEL, A., Ann. Inst. Oceanog. Monaco, t. III, 1911, fasc. 4, p. 31, fig. 13, pl. 2, fig. 4, pl. 3, fig. 2.—BALSS, H., Beitr. Naturg. Ostasiens Decap. II, Kl. d. k. Akad. Wiss. II, suppl., Bd. X, Abh., 1914, p. 77.

Family: PENAEIDAE

Genus: PENAEOPSIS A. M. Edwards

Penaeopsis monoceros (Fabricius)

Plate 18

TYPE: Fabricius' type came from the Indian Ocean and is deposited in the British Museum, if still extant.

DISTRIBUTION: Dr. Alcock records this as "one of the commonest of the Indian prawns known in the Calcutta collection from Pondicherry; Sandheads, River Hooghly; Orissa coast; Bombay; Palk Strait; off Indus Delta, 30 to 40 fathoms; Ganjam and Vizagapatan, 10 to 30 fathoms; Coromandel coast, 80 to 110 fathoms; Gulf of Martaban, 20 fathoms; Akyab; Hong Kong." Indian Ocean (Fabricius, H. M. Edwards); Hong Kong (Stimpson); Yokohama and Sagami Bay, Japan (Thallwitz); Takao, Formosa (Balss); Port Said, Suez Canal, Balikpapan, Borneo (Balss); Station 386, of Natal, South Africa (Calman); Tale Sap (Kemp); Georgetown, Penang, Malay Straits, Singapore (Boone).

MATERIAL EXAMINED: Two young specimens, from Georgetown, Penang, Malay Straits, November 13, 1931. One specimen, Singapore, November 10, 1931.

TECHNICAL DESCRIPTION: According to Dr. Alcock, who had nearly three hundred specimens for examination, this species rarely attains a length of six and one-half inches. The longest of the "Alva" specimens is only about two-thirds of this size and has the body covered with a coarse short pilosity, which is arranged in a definite pattern on the abdominal terga, having interrupting transverse bands of non-pilose, glabrous exoskeleton. The carapace is entirely pilose, except in the grooves. The rostrum is short, not quite extending to the distal margin of the antennular peduncle, nearly straight, with the distal portion slightly, almost unnoticeably, elevated. The rostral carina extends almost, or quite to the posterior margin in some specimens. There is a weak epigastric tooth, not quite in line transversely with the hepatic tooth, being slightly posterior to it and there are nine stronger, subequal teeth, the proximal one of which is well in advance of the epigastric tooth yet is above the carapace, about opposite to a small, transverse groove which runs obliquely out from the side of the rostrum. The second rostral tooth is about half as far in advance of the first tooth as the latter is from the epigastric tooth. The remaining rostral teeth are nearly subequally spaced, the distal two being a very little closer together than the others; the distal tooth is very near the tip of the rostrum. The lateral rostral sulcus extends from beside the distal rostral tooth backward behind the epigastric tooth for a distance about as far as the space between the epigastric tooth and the first rostral tooth. There is a short oblique sulcus extending outward from the side of the rostrum, below the first rostral tooth, to a point behind the base of the obscure postorbital ridge, which in reality is not a ridge but a tumid elevation behind the minute orbital spine. The antennal spine is strong and the postantennal carina is also strong, smooth, continued back almost to the anterior margin of the related postantennal sulcus which is posteriorly continuous with the tomentose, hepatic sulcus. The hepatic spine is strong, acute, and the cervical groove above it is continued about one-half way to the dorsal carina as a sharply defined groove. The sinuous subhepatic groove, which is the anterior continuation of the cervical groove, is even deeper-channeled than the upper branch and is continued anteriorly almost to the anterolateral margin. The posthepatic carina is strong and is continued as a strong, flat, sinuate carina almost to the posterior margin. Below this, defin-

ing the branchial region, there is a second carina on each side, which arises just behind the postlateral angle of the carapace and extends backward, sinuate, above the lateral margin, for almost three-fourths of the carapace length. The anterolateral angle of the carapace is rounded.

The first abdominal segment is, in some specimens, partially carinate in the median dorsal line, and the second and third segments are bluntly, inconspicuously carinate, while on the fourth, fifth and sixth segments this longitudinal carina is sharply and almost completely developed, that of the sixth segment terminating in a small tooth. The sixth segment is one and one-half times as long as the fifth segment, but is only about five-sixths as long as the telson, which is channelled longitudinally and has additionally a pair of median lateral, smooth, longitudinal carinae, one on each side of this median groove and about half-way between the carinate margin of this groove and the outer lateral margin. No marginal spines are present on the telson. The caudal fan has the outer blade produced one-third of its length beyond the telson; the outer lateral margin of this blade is nearly straight, carinate, extending to the extreme tip of the blade and terminating in a distal tooth; a secondary carina extends obliquely from the proximal end of the blade for about three-fourths of its length, terminating in coalescence with the lateral margin. The distal and inner margins are slopingly rounded, ciliated. The smaller, inner blade is intermediate in length between the telson and the outer blade, narrower than the latter and less unequally rounded distally, achieving a nearly pointed, rounded apex.

The eye is large, the dorsal end of the stalk modified into a flattish, distally rounded, calcareous plate above the cornea; the cornea is concealed beneath this process for the distal two-thirds of its dorsal depth; the cornea is ovoidal, with the ventral and outer lateral surface adjusted to afford an excellent visual range.

The antennular peduncle is not quite as long as the outer lateral margin of the scaphocerite and the inner, proximal angle of this first article is produced into a slender, tapered, acuminate, laminate process heavily setose, that lies flat beside the cornea and extends half its length beyond the cornea; the second and third articles are shortish, the longer, outer branch of the flagellum is only slightly longer than the lower branch and is but little more than half the length of the peduncle.

The antennae support a large scaphocerite, which is a little longer than the antennular peduncle and has a distinct outer lateral carina terminating in a very acute, subdistal tooth and a strong groove parallel and adjacent to this carina; the flagellum is two and a third times as long as the body.

The first, second and third pairs of legs are chelate; each has an antrorse spine on the basis.

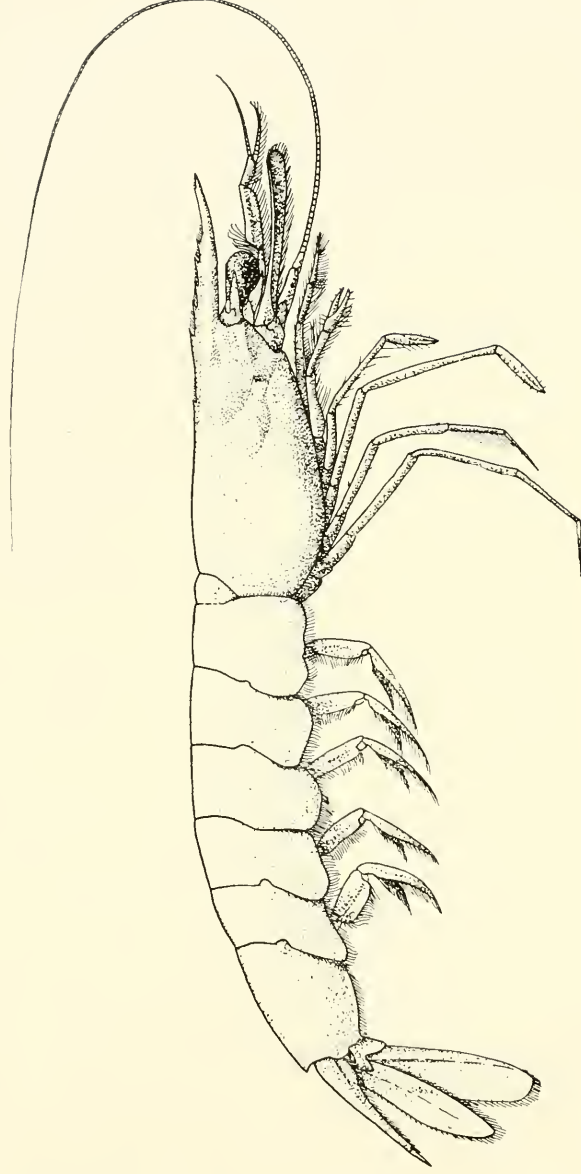
In the adult males, the fifth pair of legs are specialized, as described and figured by Dr. Alcock. The fifth pair of legs of both sexes are slender; the dactyli extending to about two-thirds of the length of the scaphocerite.

The petasma is figured by Dr. Alcock.

The thelycum is concave, the concavity being limited laterally by a pair of auricular lobes, the free, anterior margin of which is usually incurved, and anteriorly there projects a narrow, tongue-like process, with rounded distal margin. This process lies between the two rounded pad-like lobes, each of which is attached to the inner angle of the basis of the fourth leg.

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Penaeopsis macleani (Haswell), $\times 1$.

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Penaeopsis macleayi (Haswell)

Plate 19

TYPE: The type was collected at Port Jackson, New South Wales, and is a specimen about five inches long; it is deposited in the MacLeay Museum at Sydney.

DISTRIBUTION: The "Alva" specimens, twelve in number, from New Caledonia, represent the first record of this species taken outside of the coast of New South Wales, where it was originally found at Port Jackson (Haswell, Schmitt); de Man recorded two specimens from Sydney; Ogilby recorded it from the Sydney market; Miers reported from Richmond River, New South Wales; Whitelegge had two specimens from off Schoalhaven Bight, "Thetis" Station 50, depth 15-18 fathoms; A. R. McCulloch collected it at Fullerton Cove Bay and at Hawkesbury River, according to Schmitt. Phillipps reported it as the less important of the two species of edible shrimp, "abundant in the waters of New South Wales; imported in April from the Sydney market into New Zealand."

MATERIAL EXAMINED: Ten males and two females collected in Noumea, New Caledonia, September 19, 1931, by the "Alva."

TECHNICAL DESCRIPTION: Rostrum nearly straight, with slight upward curvature towards the tip, extending to about midway the third peduncular article of the antennulae and armed with one epigastric and eight rostral spines on the upper margin, these set in subequal sequence from above the orbital angle to about opposite the base of the second peduncular article of the antennulae. The postrostral carina is continuous backward for about three-fifths of the length of the carapace and is accompanied on either side basally by a lateral ridge, which accentuates the thick-

ness of the rostrum and vanishes anteriorly beyond the spines toward the apex. The inferior rostral margin is devoid of spines but is setae-fringed above the orbit. There is also a short fringe of setae on the upper margin between the spines. The rostral formula, in the twelve specimens from New Caledonia, is from six to nine teeth on the superior margin, none on the inferior margin. The carapace has the antennal spine strong, continued backward as a ridge, accompanied on the upper side by a wide antennal sulcus, the upper border of which is a less strong parallel ridge, running to the orbital angle. The orbital spine is apparently obsolete in a lateral view but is represented in a dorsal view as the slightly angled apex of that fold of carapace forming the orbital ridge. It is not a true spine, developed in degree comparable to that of the antennal and hepatic spines. The fact that it occurs immediately above the base of the ophthalmic stalk, which would rub back upon this orbital or angle spine, when the eye is elevated, may in part account for the varying degree of development or absence of an orbital spine, recorded by different writers. The twelve New Caledonia specimens have about the same degree of development of this orbital angle. Posteriorly the antennal sulcus deepens beneath the hepatic spine and is tomentose here and confluent with the strong cervical sulcus, and also with a strong sinuate subhepatic sulcus that runs back below the hepatic spine about as far as does the cervical groove above it and this subhepatic sulcus continues forward and below the hepatic spine to the frontal margin of the carapace, just above the rounded anterolateral angle. The hepatic spine is about as strong as the antennal spine. The ridge curving obliquely upward and backward from the hepatic spine and defining the lower margin of the cervical suture is fringed with short setae. There is also a short oblique sulcus on the upper part of the carapace, just below the rostral lateral ridge and slightly posterior to the first proximal rostral spine. There is a fine pilosity on the posterior sulcus of the rostral ridge and in some other areas of the median lateral carapace.

The abdomen is moderately compressed, the fourth segment is inclined to a definite median longitudinal carina on the posterior two-fifths. The fifth and sixth segments are carinate throughout their length, the latter terminating in a small distal tooth. The sixth segment is four-fifths as long as the telson. The telson is four-fifths as long as the greatest length of the uropoda and is

triangulate, with a deep groove in the medial dorsal line, the apex very acuminate. The lateral telsonic margins are setose, and on their distal half bear three pairs of small, subequally spaced, articulated spines, in addition to a fourth distal pair, one on each side, of the telsonic apex and about twice as strong as the preceding lateral pair of spines.

The eyes are set on short stalks, each of which bears on the proximal dorsal surface a small calcareous plate which has the proximal part rounded at the outer side and is produced into an acute slender triangle on the distal portion and apex. The cornea are large, reniform.

The antennulae have the first article produced from the inner proximal angle into a narrow stylet-like process which is very slender and acuminate; this first article is excavate to protect the eye; the second and third articles are strong, successively smaller; the third article extending one-half its length beyond the rostral tip; the flagellum is two-branched.

The antennae have the first article with the distal margin smooth, without a spine; the scaphocerite is about one millimeter longer than the antennular peduncle, with the outer lateral margin thickened, terminating in a subdistal tooth, the distal margin rounded unequally from the spine to the almost angle of the distal inner margin; the margin is convex on the proximal third but rather oblique on the distal two-thirds and ciliated.

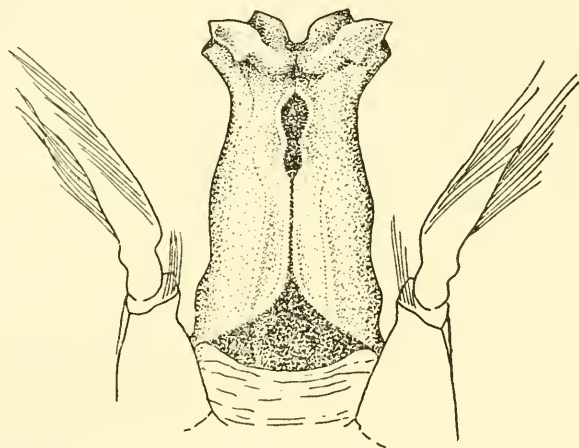
The external maxillipeds do not bear an epipodite.

There are epipodites present on the first, second, third and fourth pairs of legs; these epipodites are well developed. There are no epipodites on the fifth pair of legs.

The first, second and third pairs of legs are chelate, each with an antrorse spine present at the inner ventral distal angle of the basal joints. The third pair of legs is the longest, reaching, in the adult male, to about one-half to three-fifths of the length of the scaphocerite. In a female of the same size, this third pair of legs has the same length ratio.

The ischial joint of the third leg of the adult male is produced in an unequal-sided, triangulate tooth, apex of which is slightly curved over, inward, the tooth being situated not far from the proximal end of the joint, which is slightly hollowed, or concave, at the proximal side of the base of this tooth.

The spine on the basis of the male fifth leg is simple, slender, very acute.



Text figure 3—*Penaeopsis macleayi* (Haswell), petasma of adult male, shown from posterior side, $\times 6$.

The petasma is symmetrical, of the shape figured (text fig. 3), with the main portion consisting of a much folded membrane forming a hollowed tube-like organ, the interior of which bears longitudinal ridges, caused by folds of the membrane, and with a median sinus on the exposed outer surface of the petasma, between the lateral margins of the petasma membrane; these margins become rounded distally where the main portion of the petasma divides into two out-bent lateral portions, one on each side, forming the inferior half of a short, externally bent, internally hollowed, tubular process, with the distal aperture small; this lower half of the lower process is distinct from, but in close proximity to, the upper half of the lateral process, which is externally convex, hood-like, internally hollowed with a small, semicircular aperture, the entire upper portion curved above, or bent over the lower half of the lateral process of the petasma, the two together forming a convex, dorsally bulbous process, with the external aperture semicircular, but having just inside it a complicated convolution which leads to the internal ridges and grooves of the main portion of the petasma. Just above this lateral process is another process, which arises from the inner lateral margin of the petasma and forms a small conical process which is distinct from and curves

above the lateral process, this upper conical process having the apex directed outward laterally.

The second pleopoda of the male have the inner branch specialized, consisting of a small blade similar to, but smaller than, the inner blade of the third pleopoda, and arising at the inner side of this is a third organ, consisting of a slender, twisted, stem-like base, supporting a bulbous, subspherical distal portion which has on its ventral surface a convoluted groove.

Between the bases of the fifth pair of legs the male has a median sulcus, on either side of which there is a subtriangulate, plate-like border. Anterior to this sulcus there is a transverse hard bowed or curved ridge which has also a narrowed sulcus anterior to it.

The female thelycum consists of a transverse calcareous bar, thickened medially, and with the posterior margin convex; on the anterior side this bar gives rise to a median, rounded tubercle and a pair of curved, somewhat auricular bars, which have the free ends rounded, the ventral surface flat or slightly excavate distally. On the inner side, near the distal end of each of the auricular bars, there is a rounded convex tubercle. Very young females, three inches or less in length, lack this and have the auricular bar subacute distally. These bars are contiguous with the laminate, lozenge-like plates that arise, one each, from the inner ventral border of the basal joint of the fourth pair of legs. Each of these plates has the anterior margin slightly rounded. The general contour outlined by these bars between the fifth and fourth pairs of legs is that of a horse-shoe, with the free ends directed forward. Beneath these plates of the fourth pair of legs is seen a triangulate arrangement of the ventral plates, with the apex of median plate directed posteriorly. The first pair of pleopoda of the female are uniramous.

PATTERN: The pilosity of the carapace forms a very definite marbled pattern as follows: an elongate patch on either side of the rostral carina, this patch branching anteriorly, the outer branch occupying the median area of the space above the orbital ridge and in turn uniting with an interrupted branch that extends in broken series to the hepatic sulcus. A third branch runs out from the main subdorsal patch and extends along the lower border of the cervical ridge. There is also a second or posterior subdorsal patch consisting of two oval lobes, from the outer of which

a smaller branch diverges toward the lateral region. There is a transverse interrupted band of setae anterior to the posterior margin of the carapace.

On the second to sixth abdominal segments, inclusive, this marbled pattern of setae is also present as interrupted transverse patches on the second segment, and two such patches on the third, fourth and fifth segments and one long submedian area on the sixth segment, which on the telson is replaced by a subsimilar pattern.

SIZE: The smallest specimen of the New Caledonia series measures 90 millimeters from the tip of the rostrum to the tip of the telson; the largest of the series measures 125 millimeters in the same line.

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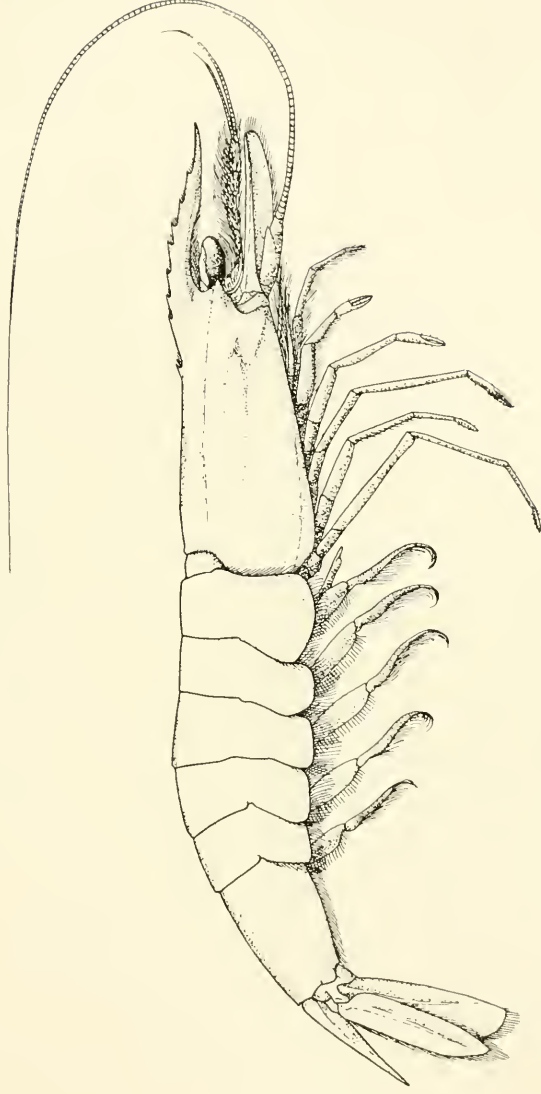
Genus: PARAPENAEOPSIS Wood-Mason, Mss., Alcock

Parapenaeopsis sculptilis (Heller)

Plate 20

TYPE: The type was collected in Java and is deposited in the Zoological Museum of Vienna.

DISTRIBUTION: Java (Heller); West Borneo (Miers); Sarawak, Borneo, Buntal, Giava, Borneo (Nobili); Singapore, market (Balss); Mergui Archipelago (de Man); India: Malabar, Sunderbunds, Gulf of Martaban, Madras (Henderson); Bombay, Mergui (Nobili); India, Gulf of Martaban, off the Cochin coast,



Parapenaeopsis sculptilis (Heller), $\times 1.5$.

Orissa and Ganjam, Dumrah River, Palk Strait, Bombay, Sandheads, Hooghly River; Hong Kong, Penang (Alcock); Penang, Malay Straits (Boone).

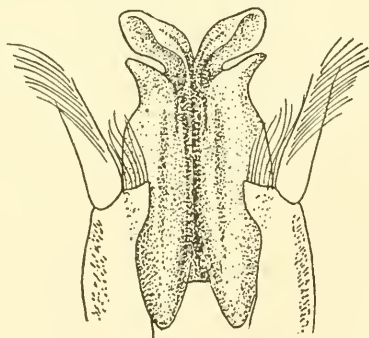
MATERIAL EXAMINED: Two males, three adult females and one young specimen, collected at Georgetown, Penang, Malay Straits, November 13, 1931.

TECHNICAL DESCRIPTION: The rostrum arises at a point about one-third of the carapace length from the frontal margin and possesses a distinct double curvature, its proximal curve bearing a crest of eight spines in addition to the epigastric spine and the distal portion is styliform, much shorter than that of the related species and scarcely reaches the tip of the antennular peduncle. The lateral rostral carina arises a short distance posterior to the epigastric spine and vanishes anteriorly below the third from distal spine. The rostral formula in the present specimens is seven spines and the apex dorsally on four specimens; eight spines and the apex dorsally on two specimens. In three specimens these spines are distributed on the proximal two-thirds of the rostrum; on the remaining specimens the last two spines are distributed on the distal styliform curve of the rostrum. The rostrum is somewhat longer in the females than in the males of the same size, which have the styliform process reduced. The rostrum length is variable, extending variously to the base of the third peduncular article of the antennulae, to the base of the flagellum, or for a slight distance beyond this point. The postrostral carina arises just anterior to the posterior margin of the carapace and is decidedly canaliculate behind the epigastric spine, which is approximately in line with the hepatic spine. The epigastric spine is weak at its base and no larger than the rostral spines from the first of which it is well separated. The margin between the teeth is ciliated. The longitudinal suture of the carapace is a fine line arising behind the orbit, continued some distance behind the gastric region, extending three-fourths of the carapace length. On either side of the carapace there is a long transverse suture line opposite the base of the fourth pair of legs and extending upward halfway to the median dorsal line; in advance of this, about opposite the base of the second pair of legs, there is a similar but shorter suture line which is scarcely half so long as the posterior transverse line. The orbital spine is definitely present, small, consisting of an acute peak formed of the folded carapace and having a very short post-

orbital buttress. The antennal spine is acute and is followed by a postantennular ridge that is oblique and extends only halfway back to the hepatic sulcus. The antennal sulcus is shallow and tomentose. The hepatic tooth is acute and the hepatic sulcus clearly defined in front of the tooth but dorsal of this hepatic spine the cervical groove is scarcely distinguished. The sinuous subhepatic groove and related ridge are continued almost to the branchiostegal tooth and the sulcus is tomentose.

The abdomen is strongly compressed laterally and is carinate in the median dorsal line on the second segment, the distal three-fourths of the third segment and the entire fourth, fifth and sixth segments, terminating in a distal tooth on this last segment. In young adults this carina is an acute ridge but in older specimens, from five to six inches long, the carina is sometimes weakly canalliculate on the anterior three segments. The telson is triangulate, with a deep longitudinal channel on the proximal three-fourths, the apex is an acute tooth, flanked by a pair of articulated strong spines, subdistal, one on either side of the base. There are no other spines present on the telson. The lateral telsonic margins are setose. The uropoda have both blades extending about one-third of their length beyond the telson; the outer blade is somewhat the larger and is narrowly oval, without a subdistal lateral spine.

The thelycum consists of a broad tumid plate arising between the fifth pair of legs and which is anteriorly bidentate, with the anterior margin rounded, a sulcus or median pit anterior to this portion, and immediately in advance of this, a wide oval plate, situated between the bases of the fourth pair of legs, and having



Text figure 4—*Parapenaeopsis sculptilis* (Heller), petasma of adult male, shown from posterior side, $\times 5$.

its anterolateral margins widely rounded, its exposed ventral face concave, this concavity increasing posteriorly. The bases of the third pair of legs are produced into elbow-like nodes at their exposed inner ventral angles.

The male petasma arises from the inner lateral face of the peduncle of the first pair of pleopoda and these plates fuse to form the curiously shaped, tubular organ shown in fig. 4; the distal end of each half is divided into a subdistal, lateral, horn-like, conical process, with a linear aperture on its distal-lateral side; immediately above this process and bent over it is the larger distal process, mouse-ear shape, which arises from the inner distal angle of the main process and forms a hood-like, externally convex, internally concave, upper aperture to the tubular main portion of the petasma. Between the bases of the fifth pair of legs is a transverse ridge posteriorly and anterior to this the surface is depressed in the median region, with a pair of small, submedian nodes anteriorly. Between the bases of the fourth pair of legs there is a small median plate with the exposed surface depressed and the anterolateral margin rounded.

The eye is short-stalked, the cornea reniform, well protected.

The antennulae have the basal peduncular article laminate beneath the cornea and somewhat concave, with a lobate-acuminate process arising from its inner proximal angle and forming the inner lateral wall of the corneal cavity; the second article is three-fourths as long as the first article; the third article is short, extending as far as does the scaphocerite; the flagella are nearly subequal in length, each branch is about as long as the outer lateral margin of the scaphocerite.

The antennae have a scaphocerite which is quite wide proximally, but much narrowed distally, the inner lateral margin tapering, while the outer lateral margin is relatively straight, terminating in a subdistal tooth, the apical margin is rounded; the second and third articles are cylindrical; the flagellum is very fine, about one and one-half times the length of the carapace.

The external maxillipeds extend to almost midway of the scaphocerite.

The first pair of legs extend to midway of the carpal joint of the external maxillipeds, while the third pair of legs exceed the maxillipeds by about the length of the related fingers. The first pair of legs differ from the others in having the ischial and meral

joints produced into a thin lamina with convex setose margin, on the exposed inner lateral margin of these articles, simulating a maxilliped. They also have a small thorn-like antrorse spine arising from the inner ventral angle of the basal joint, semiconcealed in setae. The second pair of legs also has such a spine. Epipodites are present only on the first, second and third pairs of legs. The first three pairs of legs are chelate, successively increasing in length by approximately the length of half the propodus and entire dactyl of the respective legs.

The first male pleopoda have a node or elbow-like process on the anterior lateral side of the peduncle, which the females lack.

This species attains a length of 130 millimeters, as recorded from the "Alva" material. Dr. Alcock recorded specimens having a length of five and one-half inches. Some males reach maturity at a length of two inches.

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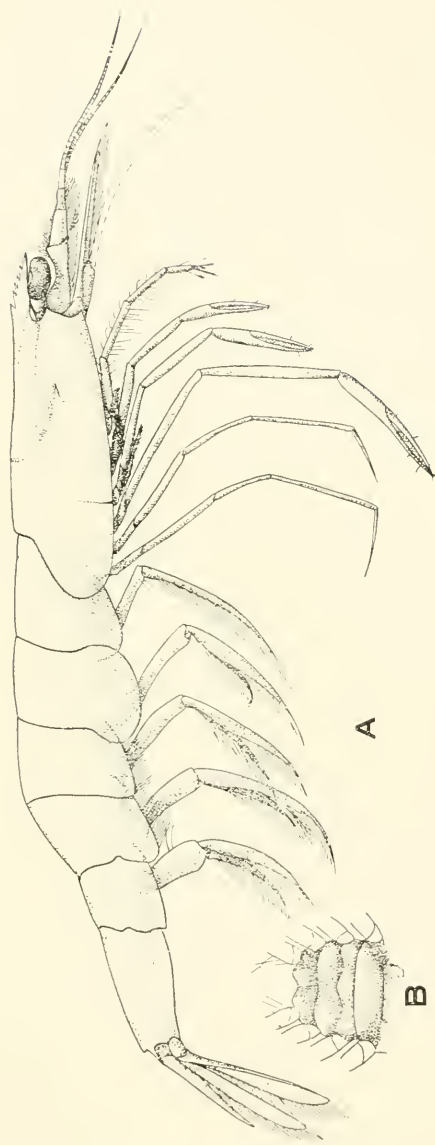
(Consult ALCOCK, 1906, for full diagnosis and early literature.)

Parapenaeopsis gracillima Nobili

Plate 21

TYPE: Dr. Nobili's type series came from Buntal, at the mouth of the Sarawak River, Borneo, and is deposited in the Torino Museum.

DISTRIBUTION: So far this species has a rather restricted distribution. It has been reported from Borneo (Nobili); Singapore



Parapenaeopsis gracillima Nobili

A, young female $\times 8$; B, telson of same, greatly enlarged

(Balss); Bagan, Api Api, Sumatra (de Man); Durian Straits (Boone).

MATERIAL EXAMINED: Two small females, taken in 14 fathoms, muddy bottom, near Equator, to the southward of South Brother's Island, south entrance of Durian Straits, Lat. 29' N. by E., Long. 104° 47' E.

TECHNICAL DESCRIPTION: The larger female is about 20 millimeters long. The carapace is 5.6 millimeters long from the apex of rostrum to the posterior margin, the rostrum being 1.2 millimeters long from apex to orbital angle. The rostrum arises as a laminate carina, about 1 millimeter posterior to the frontal margin, and is continued forward and obliquely upward for a distance of not quite one-third of the carapace length, or almost to the distal margin of the cornea. There is no epigastric spine present in either of the two females, but these are both very young. The upper margin of the rostrum is a smooth carina on the proximal two-fifths or postorbital portion, while the distal portion beyond the carapace is serrated by five acute, closely spaced teeth, in addition to the apex. The inferior rostral margin is produced into a thin, shallow lamina, which is slightly convex on the ventral margin and finely ciliated. The base of this lamina is defined from the rostrum by the lateral carina, which is continuous posteriorly with the orbital margin. The carapace is elongate, microscopically setigerous, punctate, possessing an acute postorbital tooth, also a strong, acute, hepatic tooth which is set well back upon the hepatic area. There is a strong sulcus above the hepatic spine, extending from immediately below this spine, obliquely up and backward for two-fifths of the distance to the hind margin; the upper end of this sulcus approaches but does not reach the median dorsal line. The subhepatic sulcus is contiguous with the superior sulcus at their point of origin beneath the spine, and extends obliquely downward for a short distance. The preorbital angle is an acute spine. The anterolateral angle is an acute triangle, smaller than the postorbital angle. The abdominal segments are characteristic of the genus, the anterior three segments being dorsally rounded, while the fourth, fifth and sixth segments are sharply carinated in the median line; the fifth segment terminates in a minute denticle posteriorly; the sixth segment is greatly elongated, two and a fifth times as long as the fifth segment, or subequal in length to the short, triangulate telson. The latter is quite narrow proxi-

mally, decidedly carinate dorsally, each half sloping abruptly to the lateral margin which is devoid of articulated spines, the two sides converging to form a slight apex. The telson is only two-thirds as long as the uropoda, both blades of which are longish, narrowly ovate distally, the outer one being slightly the wider; both are fringed with setae on the posterior margins.

The eye is large, reniform, the visible portion of the stalk being half as long as the rostrum; the large cornea, with its major diameter placed transversely, is a trifle longer than the rostrum.

The antennulae have the peduncle not quite so long as the scaphocerite of the antennae; the first article laminate, concave beneath the eye and dorso-distally setose; the second article is two-thirds as long as the first, chubby, cylindrical; the third article is slightly smaller and shorter than the second; the flagellum is two-branched, with the outer branch thickened proximally; the two branches each approximately as long as the scaphocerite.

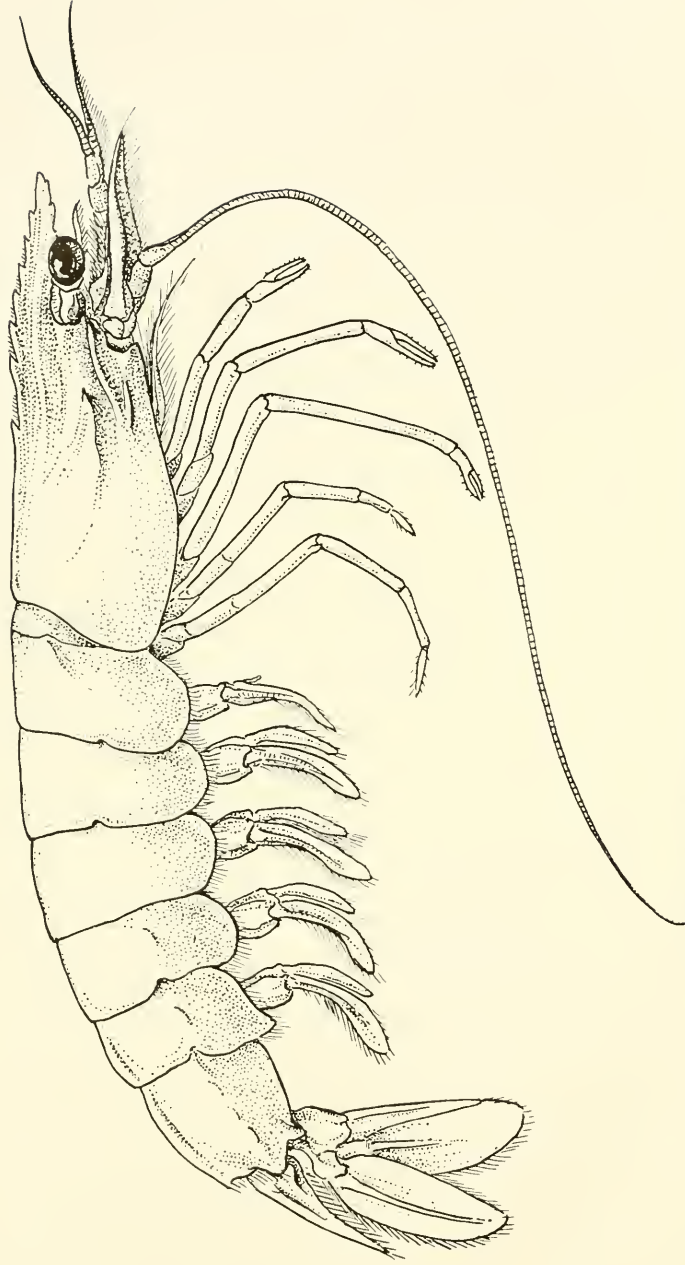
The antennae have the basicerite short, without spines, the scaphocerite extending beyond the antennular peduncle by a distance equal to about the length of the third peduncular article of the antennulae. This scaphocerite is elongate-ovate, with the maximum width about one-third of the length; the outer lateral margin thickened, terminating in a subdistal spine, the distal margin unequally convex, its greatest depth occurring at the inner side, the inner lateral margin but little convex, ciliate; the carpocerite is cylindrical, scarcely one-third as long as the scaphocerite; the flagellum, fine.

The first, second and third pairs of legs are chelate, successively increasing in size and length in the order named.

The fourth and fifth pairs of legs are monodactyl, the fifth pair being very long and slender.

The five pairs of pleopoda are strong, with the distal branches slender, quite long; the second and third pairs of pleopoda are the longest of the series.

The thelycum is well developed. Between the fifth pair of legs it consists of a transverse carina with bluntly rounded ends; this carina is superimposed on the carina between the fourth pair of legs, which consists of a similar, slightly wider, transverse bar, the anterior margin of which is sinuate, with a shallow, blunt, triangular, median lobe; the process between the third pair of legs is similar to that between the fifth pair of legs, except that its an-



Penaeus monodon Fabricius, about four-fifths of natural size.

terior margin is rounded on either end and thence slightly concave in the median region. Immediately anterior to this, between the second pair of legs, there is a transverse carina, the anterior margin of which is produced into a submedian pair of large rounded lobes, separated by a median concave area. (See Pl. 21, fig. B.)

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Parapenaeopsis gracillima, BALSS, H., Ostasiatische Decapoden II, Munchen, 1914, p. 12, figs. 5 and 6.—DE MAN, J. G., Archiv. f. Naturg. Ges., Bd. XCI, heft 1-3, 1924, p. 19.

Genus: PENEUS Fabricius

Peneus monodon Fabricius

Plate 22

TYPE: Fabricius' type came from the Indian Ocean.

DISTRIBUTION: This species is found from the Red Sea eastward to India, the Philippines and New Guinea, northward to Japan and southward as far as Port Elizabeth, South Africa. It has been reliably reported from the following places: Red Sea (Nobili); Suez (Alcock); Dar-es-Salaam, Upanga Riff, Mtoni (Ortmann); Mauritius (Miers); coasts of India (several early writers, H. M. Edwards); India, Bombay, Madras, Ganjam, "very common on the south Indian coasts and the chief edible species" (Henderson); India, Orissa, Ganjam, Gulf of Martaban, off Pulicat, Madras, Pondichery (Alcock); Ceylon, Nicobars (Heller); China (Stimpson); Japan, numerous localities (Kishinouye); Sagami Bay (Doflein, Thallwitz); Tokio, Wakanoura Kii, Nagasaki, Hizen (Rathbun); Singapore (Dana, Nobili); Java (Heller); Sumbawa Island, Dutch East Indies (Boone); Borneo (Stebbing); off Panay, Philippine Islands; "Challenger," Station 188, South of New Guinea (Bate); Thursday Island (Ortmann); Australia: Sydney, New Castle, Port Darwin, Port Jackson (Haswell); Shark Bay, Australia (Miers).

MATERIAL EXAMINED: One large specimen, taken at Bima Village, Sumbawa, Dutch East Indies, October 23, 1931.

TECHNICAL DESCRIPTION: The rostral carina extends almost to the postlateral margin of the carapace and is lightly channelled from its origin to the base of the epigastric tooth. The rostrum is nearly straight and the acute apex extends as far as does the antennular peduncle; the lateral rostral carina arises in advance of the epigastric tooth and is less distinct than is that of *Peneus indicus*. The epigastric tooth is three-fifths of the carapace length from the posterior margin, and is one and one-half times as far from the second tooth, which is approximately in line with the hepatic spine, as the second tooth is from the third tooth; the second to seventh teeth, inclusive, are almost subequally spaced, the distal upper tooth being a little in advance of the first tooth of the lower margin, which is in line with the distal corneal margin; the three teeth of the lower margin are rather closely, subequally spaced, the distal one being not far from the rostral tip. The antennal spine is an acute-tipped fold of the carapace, which forms the short, slightly oblique antennal ridge that vanishes below the hepatic spine. The hepatic spine is normal, the cervical ridge above is weak and faint, vanishing less than half-way to the dorsal line. The hepatic sulcus is deep, tomentose beneath the hepatic spine and defined below by a short, almost horizontal ridge, which vanishes abruptly some distance behind the antennal border. In *Peneus monodon* this ridge is oblique, thus differing from that of *P. semisulcatus*. The upper border of the hepatic sulcus of *P. semisulcatus* is defined along its posterior two-fifths by a short ridge which is posteriorly contiguous with the upper side of the faint cervical groove and anteriorly vanishes one and one-half times its length from the frontal border.

The abdomen is carinated on the posterior three-fifths of its fourth segment and on the entire fifth and sixth segments, this carina terminating on the sixth segment in a small spine. The telson is equal in length to the sixth segment and has a weak median longitudinal groove on the proximal four-fifths. The uropoda are typically *Peneus*.

The eye has the stalk well developed, calcareous, with several nodes and depressions on the upper surface; the cornea is set obliquely terminal, and appears reniform in a dorsal view, but nearly spherical from the lower side.

The antennulae have the peduncular articles heavily tomentose

along their lateral margins; the thicker, longer flagellum is two-thirds as long as the peduncle.

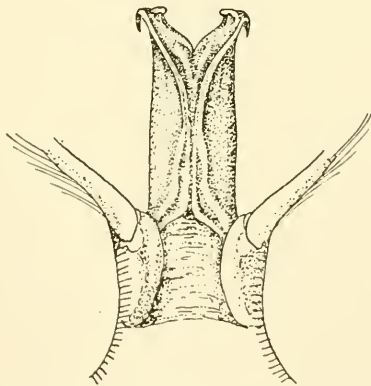
The antennae have a typical *Peneus* scaphocerite, the distal fourth of which extends beyond the antennular peduncle; the flagellum is quite long.

The external maxillipeds extend two-thirds of the length of the scaphocerite and have the rounded distal article arising from the external distal angle of the propodus and elongate-clavate, as long as the propodus and with the distal end rounded. The inner distal angle of the propodus is produced beyond the base of the dactyl as a blunt thick node, one-sixth as long as the propodus, distally truncate and supporting a tuft of setae almost as long as the dactyl. The dactyl is much compressed laterally, distally rounded, with the outer lateral and distal margins setose.

The first, second, third and fourth pairs of legs bear epipodites; there are none on the fifth pair of legs nor on the external maxillipeds.

The first pair of legs each bear an antrorse spine arising from the inner ventral, distal angle of both the basis and ischium; the second pair of legs have this spine arising only from the basis joints.

The third pair of legs is much the longest; the first pair extend to the base of the propodal joint of the third maxillipeds; the second pair of legs extend to midway the dactyl of this maxilliped; the third and longest pair of legs extend as far as the third maxilliped or slightly beyond it and is very weakly chelate.

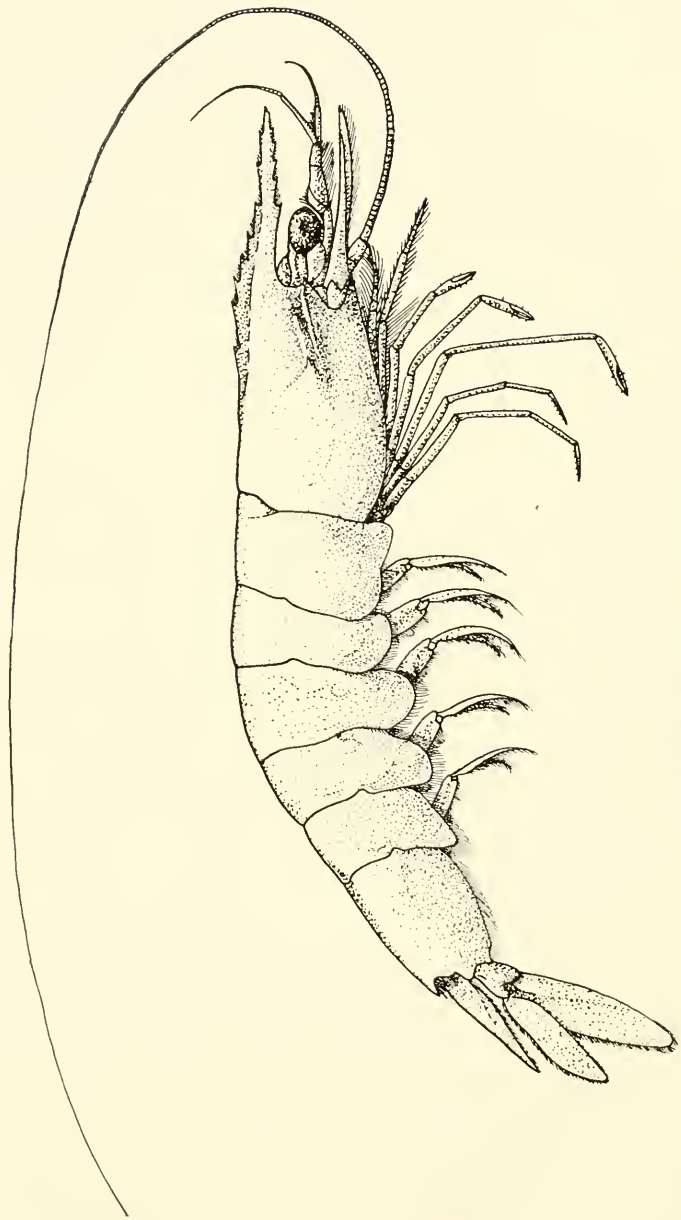


Text figure 5—*Peneus monodon* (Fabricius), petasmas of adult male, shown from posterior side, $\times 4$.

The petasma (text, fig. 5) is composed of symmetrical halves, each of which has the ventral margin curved distally, forming an acute hook which curves over the remainder of the tip. Inside this hook, on the inner surface of the petasma membrane, there is a fleshy knob-like process, and beneath it lies the rounded, curved outward margin of the ventral half of this process. The inner surface of the petasma is ridged by folds of the membrane and the inner cavity is somewhat tubular. Behind the bases of the fifth pair of legs in the male there is a thickened transverse bar that widens anteriorly into a median plate. Between the bases of the fourth pair of legs there is a median nodule.

The thelycum is figured by Dr. Alcock. It consists of a pair of semicircular plates placed with their straight margins side by side in the median line; these margins slightly bent, rim-like.

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Penaeus indicus H. M. Edwards, $\times 1$.

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***Peneus indicus* H. M. Edwards**

Plate 23

TYPE: Dr. Milne Edwards' type was collected on the coasts of Coromandel and is deposited in the Paris Museum.

DISTRIBUTION: This species is known from the Red Sea, southward on the east African coast to Madagascar; it is abundant on all the coasts of India and is known also from the Philippines, Java and Borneo. The following records for it have been published: Ghulejfaka, Red Sea (Balss); Red Sea, Obock and Massauah (Nobili); Dar-es-Salaam (Ortmann); Tulear Bay, Madagascar and east coast of Africa (Lenz); India, Coromandel coast (Edwards); Ceylon (Heller, Miers, Alcock); Gulf of Manaar (Pearson); India, Pondichery, Madras (Nobili); Akyab, Karachi, Madras, Calcutta (Henderson); all coasts of India and Ceylon from Karachi to the Andamans, Orissa and Ganjam, Malabar coast; Madras, Pulicat, Madras; Hooghly Delta, Bombay, Colombo, Ceylon, Andamans, Singapore (Alcock); Singapore (Dana); Java (Heller); Batavia, Quilimane (Hilgendorf); Philippine Islands, "Challenger," Station 203 (Bate); Cheefoo, Amoy (Miers); Luaha Gundre, Nias, Sarawak, Buntal, Borneo (Nobili); Buntal (Lanchester).

MATERIAL EXAMINED: Two males and one female, taken at Singapore, Malay Straits, November 10, 1931.

TECHNICAL DESCRIPTION: This species, in many respects, resembles *Peneus semisulcatus* de Man, but *P. indicus* possesses considerable variation within the species, so much that three subspecies have been established, namely, *merguiensis* de Man (1888), more recently set apart as a distinct species by the same author (1917), and variety *penicillatus* Woodmason, Mss., Alcock (1905), and subspecies *longirostris* de Man (1892). The species *P. indicus* is said to attain a length of about eight inches. The "Alva" specimens are small, the male here described being only about 125 millimeters long, while the largest female is about 130 millimeters long, both measurements being from tip of the rostrum to tip of the longer uropod blade.

The rostral carina rises slightly less than one-fourth of the carapace length from the posterior margin, and is paralleled on the anterior half by a lateral rostral carina, which emphasizes the slight rostral crest; this carina begins about opposite the epigastric tooth and vanishes anteriorly approximately above the corneal margin, or below the sixth rostral tooth. The rostrum which Dr. Alcock describes from large adults as having "a manifest double curve" has this double curve only faintly indicated in the present specimens. In the large female of the present series, the rostrum extends as far forward as the tip of the scaphocerite and has the dental formula $\frac{7}{4}$, the epigastric spine being approximately in line with the hepatic spine transversely, while the first and second rostral spines are above the carapace, the second spine being slightly in advance of the orbital angle, while the third, fourth and fifth spines are above the orbit, and the sixth or distal spine is about opposite a point midway the second peduncular article of the antennulae; the first rostral spine represents the highest point in the rostral crest, and the first, second, third and fourth rostral spines are subequally spaced, the fifth spine being farther in advance of the fourth than are the preceding spines, while the sixth spine is about as far in advance of the fifth as the latter is from the fourth spine. The rostrum is strong, the acute tip extending about as far forward as does the scaphocerite; the rostral spines of the ventral margin are four, the first one being above the corneal margin, the second opposite the distal spine of the upper series; the third and fourth spines of the lower series are sub-

equally spaced, dividing the remainder of the lower rostral margin into three parts.

The large male has the rostral formula $\frac{8}{5}$, and the very acute apex extends beyond the scaphocerite for a distance equal to the length of the second peduncular article of the antennulae. The extra spines are distributed on the distal portion of the rostrum.

The second male has the rostral formula $\frac{8}{6}$, the extra spines being distributed on the distal portion of the rostrum, the sixth inferior spine being very near the tip.

The carapace of the male is smooth, has no orbital spine and no true angulation of the carapace at this point. The antennal spine is acute above the rounded antennal margin and is continued backward as a ridge which vanishes opposite and anterior to the hepatic spine; above this ridge and parallel to it is a distinct sulcus that vanishes beneath the hepatic spine; there is no inferior, or subhepatic, sulcus or ridge. The upper margin of the antennal sulcus is defined by a moderate carina from a point opposite the hepatic spine for almost two-thirds of the distance to the frontal margin of the carapace; this ridge is slightly oblique, subparallel to the antennal ridge. The cervical groove is confluent anteriorly with the hepatic and curves backward above the hepatic tooth, almost halfway to the rostral carina. The fact that these antennal and hepatic spines are weaker, the sulcus less deep and the defining ridges less salient and that there is no subhepatic ridge present, render *Peneus indicus* distinct from *P. semisulcatus* de Man.

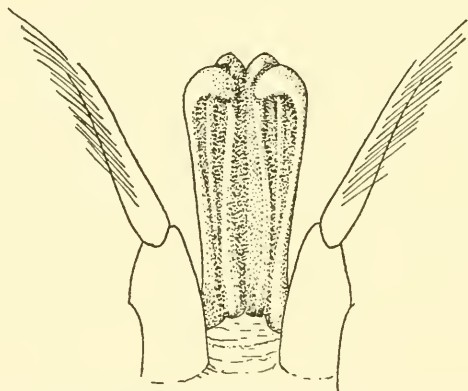
The posterior three-fifths of the fourth abdominal segment and the entire fifth and sixth segments are carinate in the median dorsal line, this carina terminating in a small, distal tooth on the sixth segment. The sixth segment is equal in length to the telson. The telson is triangulate, with a strong median dorsal groove extending to near the tip; the apex is acute; the distal half of the lateral margins is finely ciliate. The uropoda have the outer blade projecting nearly half its length beyond the telson; narrowly ovate, with the tip unequally rounded; the inner blade is shorter and narrower with the tip even more unequally rounded, the inner side being somewhat obliquely truncated toward the outer tip and slightly rounded.

The eye has a distinctive node on the outer dorsal, frontal side of the stalk; the cornea is broad, reniform, and well protected.

The antennulae have the plate arising from the proximal inner angle of the first peduncular article very narrow for two-thirds of its length, widening distally into an oval process. The second and third articles are successively shorter, the third article extending as far as the subdistal tooth of the outer margin of the scaphocerite; the flagellum has the thick, longer whip about as long as the scaphocerite; the lower branch is two-thirds as long as the upper one and much finer.

The antennae are typically *Peneus*, the scaphocerite with a subdistal, lateral tooth and the distal margin with a weakly rounded, subtriangulate contour.

All five pairs of legs possess epipodites. The first pair of legs has an acute, antrorse spine developed at the inner ventral angle of each the basis and ischium. The second pair of legs has such a spine on the basis only.



Text figure 6—*Peneus indicus* (H. M. Edwards), petasma of adult male, slightly opened, shown from posterior side, $\times 6$.

The male petasma is simple (fig. 6), composed of equal halves, with the inner ventral margins thickened, side by side, terminating in a small, rounded tip, bent over; a distinct groove runs along the inner face of this margin; beyond this margin the membrane is bent into a lamina, widely rounded distally, narrowed ventrally and bent over, forming a tubular cavity within each half, the inner face of this tube is marked by a longitudinal ridge which divides it into two grooves besides the above described ventral groove. In larger males, the petasma may be more developed than the one above described.

The ventral surface of the male, between the fifth pair of legs, bears a strong, median longitudinal ridge, on either side of which there is a sulcus, bounded externally by a curiously thickened, elongate plate, rounded on the posterior and anterior margins and with the inner surface transversed by a deep curved groove, accentuated by thick-ridged margins. Between the fourth pair of legs is a transverse bar posteriorly from which arises a distinct median longitudinal short ridge, distally subacute.

The female thelycum is located principally between the fifth pair of legs, is composed of two plates, which together form a large, circular pad, each half having the straight inner margin bent downward, rim-like, on the ventral surface; a moderate median ridge or tooth occurs on the ventral line, separating the two halves anteriorly and forming a small, rounded plate between the bases of the fourth pair of legs in the median area. Anterior to this plate there is a small depression and the third pair of legs each bears a longitudinal, sulcated lamina, arising from the proximal inner face of the basis.

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Peneus merguiensis de Man

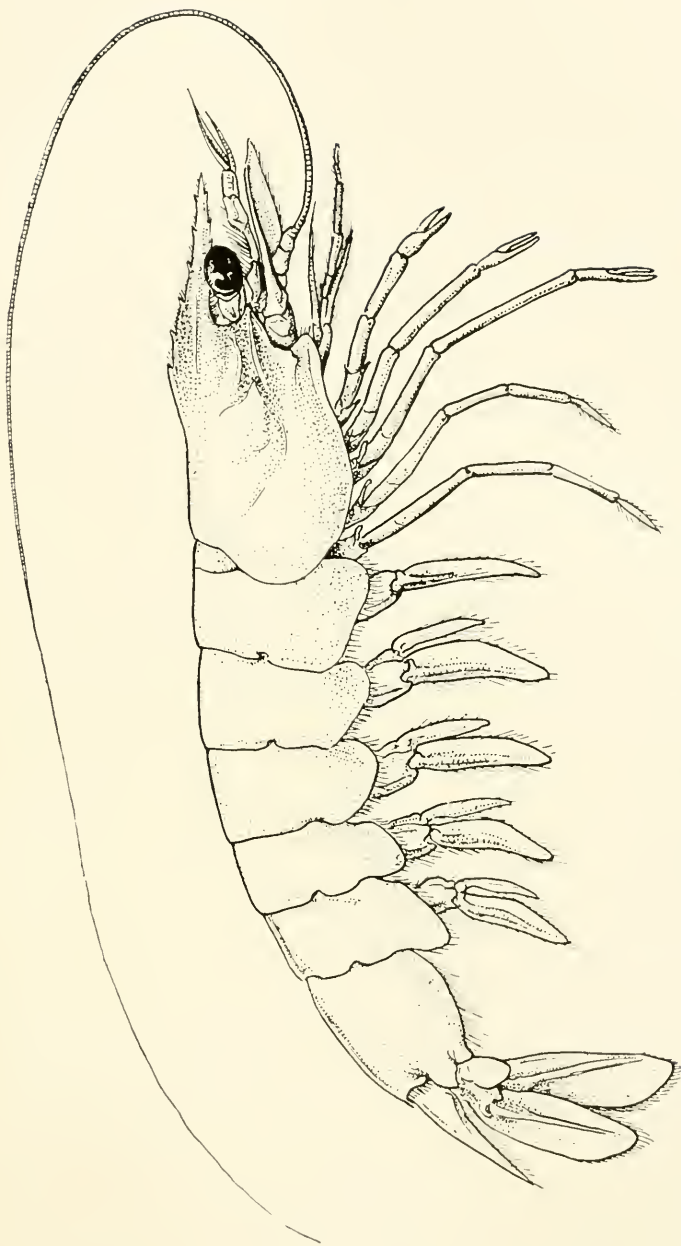
Plates 24

TYPE: The type series, consisting of five males and two females, was collected in the Mergui Archipelago and is deposited in the Leyden Museum.

DISTRIBUTION: Mergui Archipelago, Java Sea, Makassar, Celebes (de Man); Makassar (Rathbun); India: Karachi, Bombay, Palk Straits, Orissa, Ganjam, Hooghly Delta (Alcock); Philippine Islands (Bate); Atjatuning, west coast of New Guinea, "Siboga," Station 169 (de Man); Noumea, New Caledonia (Boone).

MATERIAL EXAMINED: Five specimens, collected in Noumea, New Caledonia, September 19, 1931.

TECHNICAL DESCRIPTION: The rostrum is about one millimeter shorter than the peduncle of the antennulae; the rostral carina extends about three-fourths of the length of the carapace (measured from the inner orbital angle to the posterior margin); this carina is produced into a laminate, triangulate crest, being elevated some distance posterior to the epigastric tooth, this elevation increasing to the next tooth and thence decreasing to the third, fourth and fifth teeth successively, at which point the crest vanishes as does also the carina which defines this crest basally, extending along the upper lateral margin of the rostrum, from this fifth rostral tooth backwards to a point midway between the epigastric and the first rostral tooth. The rostrum, beyond this triangulate crest, extends forward and slightly downward, is thick, compressed cylindrical, with a sharp point and has dorsally, in addition to the cervical tooth and five teeth of the triangular crest, a sixth, subdistal tooth, placed well back from the apex; on the ventral surface of the rostrum there are five teeth, the proximal one of which is just above the tip of the eyestalk, approximately opposite the fifth dorsal rostral tooth; the second, third and fourth ventral teeth are subequally spaced, the fourth tooth being slightly in advance of the sixth dorsal tooth, while the fifth



Penaeus merguensis de Man, about five-sixths of natural size.

ventral tooth is about halfway between the sixth rostral tooth and the apex. In a short angle between each rostral tooth, dorsal and ventral, and the rostrum, there is a short fringe of fine cilia, especially between the second to fifth dorsal rostral teeth, where the cilia extend the entire rostral margin. The proximal rostral tooth of the dorsal margin is set about as far in advance of the epigastric tooth as the latter is in advance of the origin of the dorsal carina. The second rostral tooth is only two-thirds as far in advance of the first one as the latter is separated from the gastric tooth; the second, third, fourth, fifth and sixth rostral teeth are almost subequally spaced, but of slightly varying degrees of acuteness. There is no postorbital tooth or ridge present. The antennal tooth is small, acute, and is continued backward as an oblique ridge to a point slightly in advance of the hepatic tooth. Above and parallel with this postantennular ridge there is a moderately deep postantennular sulcus, which is tomentose posteriorly beneath the hepatic spine. The hepatic spine is weak, acute, and the hepatic sulcus is shallow and vanishes almost immediately below the spine, while on the superior margin it is continuous with the moderately shallow cervical groove, which vanishes about midway its course to the median dorsal line. There is no hepatic ridge or groove defining the branchial region anteriorly. There are no other spines or grooves upon the carapace, which is moderately compressed, laterally, and dorsally rounded, on the posterior fourth.

The abdominal segments are moderately compressed laterally and are dorsally rounded on the anterior three segments, but on the fourth and fifth segments are each rounded on the anterior third, but are carinated in the median line on the posterior two-thirds, these carinae terminating distally in obsolescence; the sixth segment is one and two-thirds times as long as the fifth segment, and is definitely carinate in the median dorsal line throughout its entire length, terminating posteriorly in a small point above the telson. The telson is six-sevenths as long as the sixth segment and is emphasized by a strong, median longitudinal sulcus through the proximal three-fourths of the dorsal surface, the distal fourth being smooth, rounded. On either side of this median groove, the lateral portions of the telson slope rather obliquely to the lateral margins, which are non-spinose, finely crenulate and setose, converging distally to an acute apex. The uropoda are

strong, the peduncle and outer blade together being four-fifths as long as the telson; the peduncle, dorsally flat, is divided distally into a rounded outer lobe above the base of the outer blade and a narrower pointed lobe above the base of the inner blade. The outer blade is one and one-fourth times as long as the telson and is thickened on the outer side but has no subdistal spine; the outer lateral margin is nearly straight, while the inner lateral margin is more rounded in the median region and narrowed toward the rounded apex. The inner blade is only three-fourths as long as the outer, of the same width, but more obliquely truncated distally on the inner distal margin.

The eye is large, the stalk dorsally flattish, with a blunt node at the outer proximal lateral angle; the cornea is large, reniform, set obliquely terminal, with excellent peripheral visual range. The distal margin of the cornea extends slightly beyond the fifth dorsal rostral tooth.

The antennular peduncle extends about 0.5 to 1.0 millimeter beyond the tip of the rostrum in large specimens; the first joint is greatly modified for the protection of the eye, being produced into a double laminate process curved over on the outer and upper proximal border, the inner pointed portion of this process forming a support beneath the eyestalk, while the more curved outer portion protects the cornea; setae fringe both portions; the distal half of the lateral border of this article is thickened, tapered to a point and setae-fringed on both upper and lower lateral margins; the article is laminate-concave beneath the cornea and setae-fringed across the distal border, which is just beyond the cornea; the proximal inner lateral angle is upcurved and supports a narrowed, elongate, scaphocerite-like process that extends in a vertical plane along the inner marginal line beyond the cornea to about midway the second peduncular article; this process is narrowed proximally, widening distally, the outer lateral margin sinuate, corresponding to the adjacent orbital lateral margin, and is oar-blade-like distally, being also setae-fringed on the outer and distal margins; the second article is strong, three-fourths as wide as long, quite thick in the median region, sloping towards the lateral margins; the third article is shorter and narrower, rounded at the outer distal angle which supports the smaller branch of the flagellum, the thicker, superior branch arising from the outer angle of the peduncle and extending for a distance equal to four-

fifths of the carapace; the proximal third of the branch is thick, composed of numerous small rings, the distal two-thirds is fine and thin; the inferior branch is very fine and only two-thirds as long as the superior branch.

The antennae have the first peduncular article strong, with the dorsal margin unevenly rounded; the inferior distal outer angle produced to a strong lateral point; the second and third articles are reduced, especially the second article, both lying beneath the scaphocerite and together extending less than one-fourth of its length; the flagellum is one and one-half times as long as the entire body. The scaphocerite is widest across the proximal fourth, the inner lateral margin being convex here and tapering distally; both distal lateral margins converge nearly obliquely from a point opposite the subdistal lateral spine, toward the apex, which is bluntly rounded; the inner lateral border has a fine web of short setae, which become shorter toward and on the distal margin. The scaphocerite extends the distal third of its length beyond the rostrum and is elongate, with the outer lateral border thickened and terminating in a small, subdistal tooth. The inner lamina is thinner and on the inner distal portion is marked by a series of oblique grooves alternating with ridges that radiate toward the outer margin.

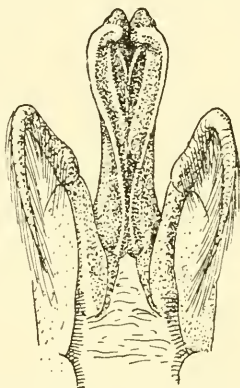
The external maxillipeds of an adult male extend more than two-thirds of the length of the scaphocerite and have the dactyl modified, it being about three-fifths as long as the outer, longer margin of the propodus; the dactyl arises from the inner distal angle of the propodus, is cylindrical, but tapered to a narrowed point both proximally and distally and beset with a few setae on the proximal inner lateral margin; the outer distal angle of this propodus is a blunt node that projects beside the narrowed base of the dactyl nearly a fifth of its length and is tipped distally with a dense tuft of setae which is nearly half as long as the dactyl. The female dactyl is three-fourths as long as the propodus, tapered distally only, and is setose on both margins.

In both sexes the first and second pairs of chelipeds have the merus produced at the ventral inner distal angle into an antrorse spine; on the first pair of chelipeds only the same ventral inner distal angle of the ischium is similarly but less acutely produced. The third pair of chelipeds is the longest of the series and in adult males and large females usually extend almost to the

tip of the scaphocerite. This length differs somewhat according to sex and age.

All five pairs of legs have epipodites, but those of the fifth pair are shorter than those of the preceding pair.

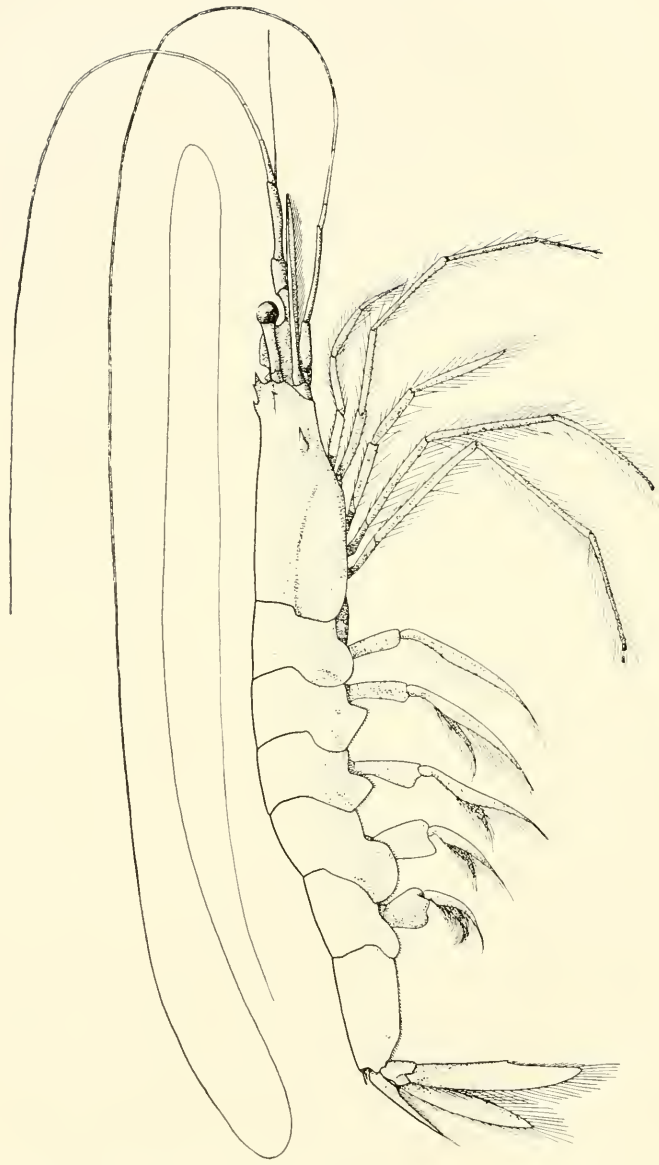
The thelycum is a subcircular plate, composed of two halves, lying side by side, with their inner lateral margins straight, thickened into a lip-like ridge, protruding ventrally and separated from their anterior margin by a narrow, short, median ridge that extends slightly anterior to the circular plate for about one or two millimeters, and continues posteriorly between their inner lateral margins for almost a third of the length of the thelycum.



Text figure 7—*Peneus merguensis* de Man, petasma of adult male, shown from posterior side. Enlarged.

The petasma is figured (see fig. 7). It arises about midway the inner lateral margin of the peduncular article and consists of two plates united to form a tubular organ; the ventral-lateral margin of each plate is curved and distally rounded; these tips curve inward to the mouth of a second tube, formed by the ridge of the inner fused margin of the two halves; the apex of this ridge is produced into a rounded process bent over above the curved ventral apices.

The male receptacle consists of a median ridge in the anterior of the space between the fifth pair of legs; this ridge is produced to a ventral median ridge and slopes to either side. Separated from the entire ridge are a pair of plates, one on either side, which project as far forward as the basis of the leg and have the anterior distal border unequally lobate. The space between the fourth pair



Acetes indicus H. M. Edwards, \times about 4.

of legs also has a median node, but is less ridged or carinate in the median line.

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Family: SERGESTIDAE

Subfamily: Sergestinae

Genus: ACETES H. M. Edwards

Acetes indicus H. M. Edwards

Plate 25

TYPE: The original record of this species was from the mouth of the Ganges. The type is deposited in the Museum of the Jardin des Plantes, Paris.

DISTRIBUTION: Ganges Delta (H. M. Edwards) ; Bombay, Bay of Bengal, Gulf of Siam (Kemp) ; southern end of Durian Strait, Dutch East Indies (Boone). I concur in Mr. Kemp's decision that the records of Dana, Walker, Henderson and Pearson are open to doubt, owing to the insufficient analysis of the species by Dr. Milne Edwards.

The "Alva" record substantially extends the southern record of this species. The present specimens were obtained in salt water. This species has been reliably reported from both brackish and salt waters.

MATERIAL EXAMINED: Fifty-four specimens, taken in 14 fathoms, on muddy bottom, near Equator to the southward of South Brother's Island, south entrance of Durian Straits, Lat. 29' N. by E., Long. 104° 47' E. The series includes adult females and immature males.

TECHNICAL DESCRIPTION: The adult females conform in all details with Mr. Kemp's description, which was based on what

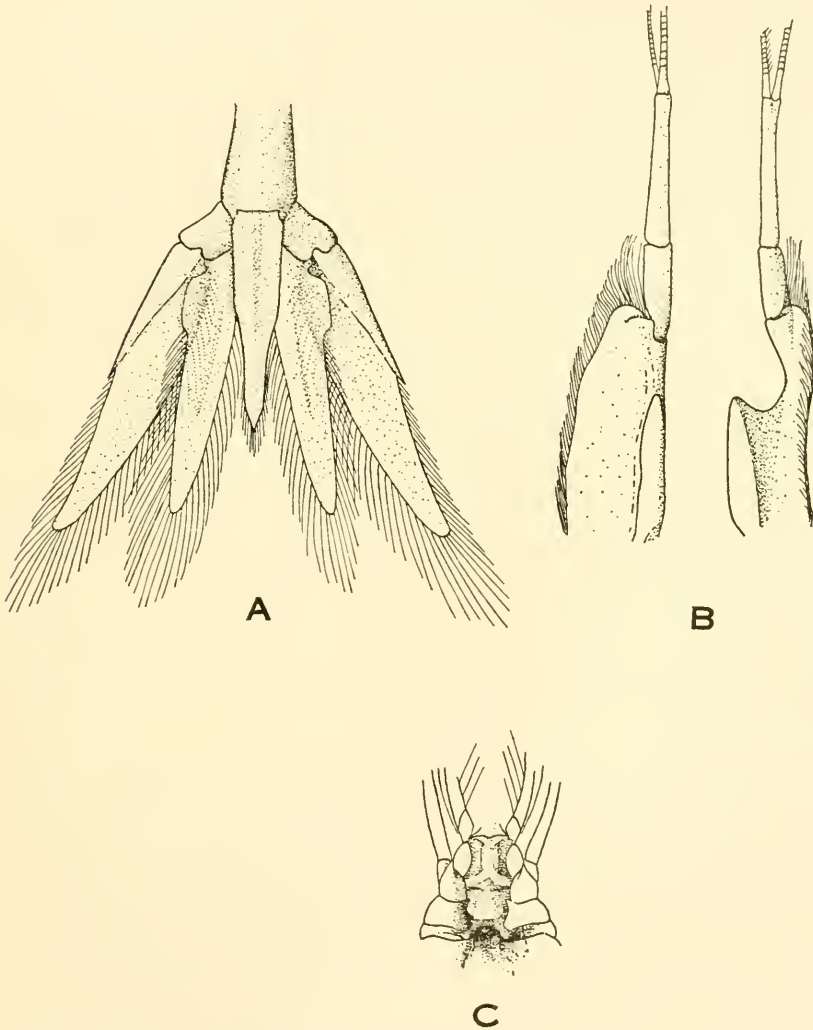
is by far the most comprehensive series of this species examined by any one writer. Unfortunately this excellent small paper of Dr. Kemp's was overlooked by Dr. Hansen in his report on the "Siboga" Sergestidae, consequently these four species of *Acetes*, including the new species *Acetes insularis* Kemp from the mouth of the Rajang River, Sarawak, Borneo, discussed by Dr. Kemp, are omitted from Dr. Hansen's monograph.

The carapace is semitranslucent, slender, produced to a short rostral crest, the upper margin of which is bidentate, in addition to the small triangulate apex, which protrudes beyond the frontal margin minutely. The supraorbital spine is well developed and is approximately in line transversely with the posterior rostral spine. The hepatic spine is well developed and set well back on the carapace, about one-third of the total carapace length from the margin. There is a pronounced strong groove, margined on either side by a distinct ridge that arises below and a little behind the hepatic spine about midway the length of the lower lateral region and curves up a short distance and thence proceeds nearly straight back to the posterior margin.

The abdominal terga are slender, quite compressed. The sixth segment is about twice as long as the preceding segment; the telson is three-fifths as long as the sixth segment, or half as long as the outer blade of the uropoda, with a deep median groove for the proximal two-thirds of its length; the sides of the telson are convergent to a sharp, triangular apex. The angular ending of the lobe, defining the proximal end of the inferolateral margin, is situated about two-fifths of the length from the base of the telson. The uropoda are quite slender, the shorter, inner blade is two-fifths longer than the telson and the outer blade is about twice as long; both have their greatest width proximally and each has the two lateral margins quite convergent; the tip is quite narrowed, rounded. The outer blade has the outer lateral margin a little thickened, this part terminating in a small tooth, which in adults is placed from 55 to 65 per centum of the total length, the distal portion of the margin being ciliated. In young specimens this ciliated area is shorter.

The eye of the adult female is characteristically long, being one-half as long as the carapace; the eye, measured from the dorsal proximal border of the stalk to tip of the cornea, is 3.5 mm. long; the carapace is 7 mm. long, from tip of rostrum to

posterior margin of carapace. The eyestalk is distinctly slenderer than the cornea, the transverse diameter of the stalk, midway its length, being 0.75 mm., the cornea transverse diameter 1 mm. The distal article of the stalk is 2.2 mm. long, the cornea is 1 mm. long.



Text figure 9—*Acetes indicus* H. M. Edwards, A, telson, $\times 8$; B, antennular peduncle, dorsal and profile views, $\times 12$; C, thelycum of adult female, $\times 12$.

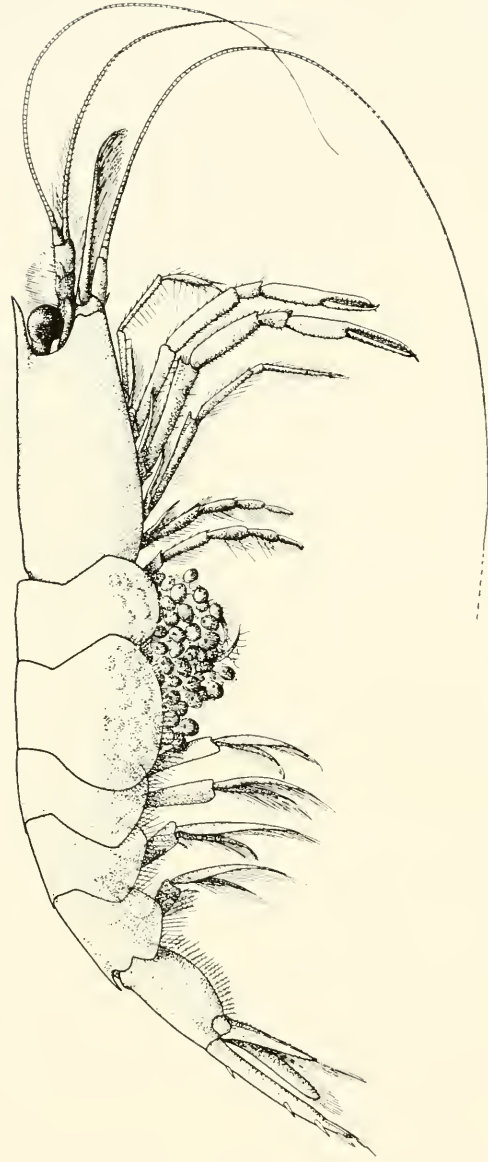
The female antennular peduncle has the first article about as long as the second and third articles considered together, laminate, suboval, with the characteristic vertical leaf-like process on the proximal inner lateral margin, this process tapered distally and extending as far as the eyestalk; the outer lateral margin of this first article has a slight incision approximately opposite the distal apex of this inner lateral process; the second article is shortest, being three to three and a half times as long as wide; the third article is 1.7 times as long as the second and is from 5.8 to 6.5 times as long as wide. In the adult males the second segment of the antennular peduncle is sometimes, but not always, slenderer in ratio to its length than it is in adult females; the third peduncular segment of adult males is greatly elongated, being about 1.7 times as long as the related first article and quite slender, being eleven to fourteen times as long as wide. The distinctive characters of the specialization of the male antennular flagellum are figured by Mr. Kemp. There are no adult males in the present series of specimens.

The female antennular flagellum is two-branched, very fine, the inner, longer whip being about equal to the total body length and distinguished by a characteristic flexure.

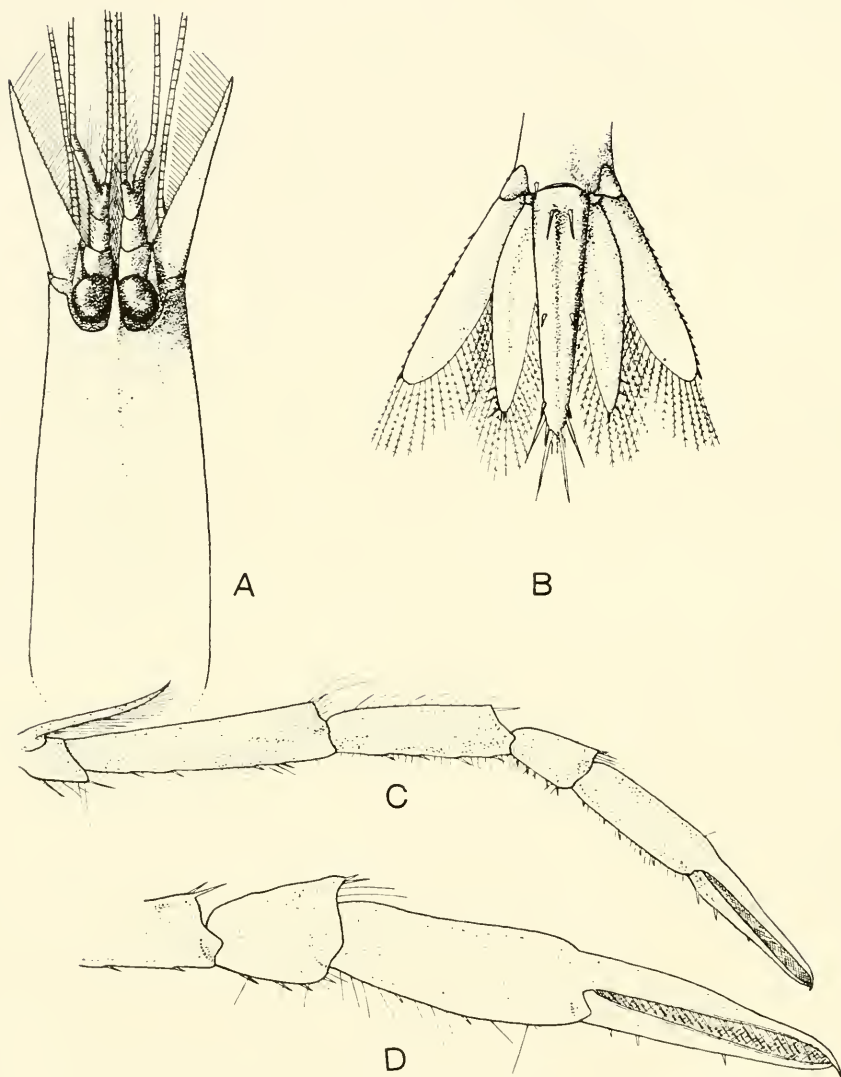
The antennae have the scaphocerite widest proximally, three and one-half to four times as long as the greatest width, with the outer lateral margin quite convex, tapered distally and terminating in a small tooth that extends slightly beyond the rounded, inner, distal margin. In the adult female this scaphocerite extends to about midway the distal peduncular article of the antennulae, or approximately extends beyond the orbit for the distal half of the scaphocerite.

The mandibular palp and second maxillipeds conform to the generic characterization. The third maxillipeds present a secondary specific character in that the basal segment is moderately stout; when extended forward, these maxillipeds reach beyond the tips of the third pair of legs, and in the females, much beyond the tip of the antennular peduncle. The distal article of the maxillipeds is uniarticulate; the related setae are fairly stout.

The legs have the basal article fairly stout. The basis of the third pair of legs bears a distinctive large tooth on the inner margin, near the insertion of the ischium.



Leptochela pellucida Boone, type $\times 6$.



Leptochela pellucida Boone, type, dorsal view of anterior of specimen; B, dorsal view of telson; C, first leg; D, distal joints of same leg; all greatly enlarged.

Both males and females have on the median ventral surface of the second abdominal segment a strong procurved tooth, which is not cited in the descriptions of any other species of *Acetes*.

The petasma is carefully figured by Kemp (*loc. cit.*). There are no adult males in the present series.

The adult female has the thelycum located principally on the third thoracic sternite with the anterior margin deeply sunken, concave transversely; this sternite is deeply channelled longitudinally, this channel being continued onto the anterior portion of the fourth segment. There is a pair of submedian, rounded tubercles, one on either side, behind the inner angles of the coxal joint of the third pair of legs. (Text, fig. 8c.)

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? *Acetes indicus*, DANA, J. D., Rept. U. S. Explor. Exped. Crust., vol. XIII, pt. 1, 1852, p. 608.—?, WALKER, A. O., Journ. Linn. Soc. Zool., vol. XX, 1890, p. 112.—? HENDERSON, J. R., Trans. Linn. Soc. Zool., ser. 2, vol. V, 1893, p. 452.—?, PEARSON, J., Rept. Ceylon Pearl Oyster Fisheries and Marine Biol., pt. 4, 1905, p. 75.

Family: PASIPHAEIDAE

Genus: LEPTOCHELA Stimpson

Leptochela pellucida new species

Plates 26 and 27

TYPE: An adult female dredged in 14 fathoms, near Equator, to the south of South Brother's Island, south entrance of Durian Straits, Dutch East Indies; Lat. 29' N. by E., Long. 104° 47' E. Deposited in the Vanderbilt Marine Museum, Cat. No. 735.

MATERIAL EXAMINED: Type.

DISTRIBUTION: So far restricted to the type locality.

TECHNICAL DESCRIPTION: Adult female: Carapace decidedly compressed laterally, elongate, smooth, except for the distinct median dorsal carina that arises about one-third of the carapace length from the posterior margin and continues forward as a compressed ridge, becoming accentuated distally as a folded or carin-

ate, upward directed, triangulate, acuminate rostrum that extends above the eyes semihood-like and reaches slightly beyond the distal corneal margin, or to the base of the second article of the antennular peduncle. On either side of and immediately adjacent to the rostrum, the frontal margin of the carapace is rather deeply concavely excavate above the eye, the postorbital angle being rounded and the lower frontal margin truncate and closely appressed with the anterolateral angle also closely appressed to the body and rounded as in the genus *Crangon*. The posterior margin of the carapace is decidedly concavely excavate across the median dorsal region, this excavation showing the only visible portion of the first abdominal segment; the rounded anterolateral margins of the second abdominal segment overlap the postlateral margin of the carapace.

The abdominal segments are moderately compressed laterally, glaucous, semitranslucent; the first and second segments with deep, widely convex lateral borders; the rather large clutch of eggs being held beneath these two segments and anterior to the second pair of pleopoda; the third, fourth and fifth segments have the lateral margins less produced, shallowly rounded. The posterior third of the third segment and the entire fourth and fifth segments are weakly carinate in the median dorsal line; the fifth segment is produced posteriorly in the median dorsal line into an acute, subdistal spine, the apex of which scarcely exceeds the posterior margin of this segment. The sixth segment is no longer than the fifth and bears a small blunt tubercle proximally in the median dorsal line but has no carina. The telson is 2.5 millimeters long, or one and one-fourth times as long as the sixth segment, not decidedly tapered for about five-sixths of its length, the dorso-lateral borders, consisting of a pair of decided ridges, one on each side, separated throughout their length by a pronounced median longitudinal channel; the true distal margin is narrow, each half converging to form a small triangular apex. There are three pairs of articulated spines on the dorsal surface of the telson, the first pair being subproximal, the second pair about midway the length, and the third pair subdistal, nearly marginal, one spine of each pair being placed on each side on the longitudinal ridges. The distal telsonic margin has a small pair of submedian, short spinules; outside of these there is the one pair of long, acuminate spines, each of which is equal in length to the distance between

the second and third pairs of dorsal telsonic spines; outside of these is another single pair of similarly acute spines, one-half as long as the longest pair and arising from the ventral margin of the outer telsonic angle. There are no telsonic marginal setae present. The uropoda are slender, the peduncle short, strong, the inner blade quite narrowed, sub lanceolate distally, dorsally, with a pair of submedian longitudinal ridges, separated by a deep channel, similar to those of the telson; the outer blade is differently shaped, wider than the inner blade, but not quite so long as the telson; the inner lateral margin is convex, tapered distally to an obliquely narrowed, convex, distal margin; the outer lateral margin is straight, armed with thirteen or fourteen articulated spinules besides the fixed distal spine; there is a dorsal longitudinal channel on the outer blade also, but no heavy ridges such as appear on the inner blade. The uropoda are shorter than the telson.

The eyestalks are short and semiconcealed beneath the carapace, lying side by side, only a line of the distal stalk margin adjacent to the cornea, showing beyond the carapace. The cornea are large, black, composed of rather large facets; the cornea is set obliquely terminal upon the stalk, with an excellent dorsofrontal visual range.

The antennulae have the first peduncular article expanded beneath the orbit and extending slightly beyond the cornea, distally furnished with short, brush-like setae; the second article is short, cylindrical; the third article is similar but one and one-half times as long as the second, the peduncle extending a little over one-half the length of the scaphocerite; the flagellum is biramous, the inner branch being about as long as the entire carapace, the outer, slenderer branch being about one-third longer than the inner branch.

The antennae have the basicerite dorsally almost concealed by the appressed carapace but having an acute tooth-like process ventrally, supporting the scaphocerite. The scaphocerite is four-fifths as long as the carapace, with the outer lateral margin thickened and not entirely straight, the inner lateral margin oblique, tapering distally toward the outer lateral margin and forming an acuminate stylet; there is no inner convex distal portion of the scaphocerite whatever, this oblique inner lateral margin being fringed with long web-like setae. The scaphocerite is cylindrical and extends half the length of the scaphocerite or to about midway

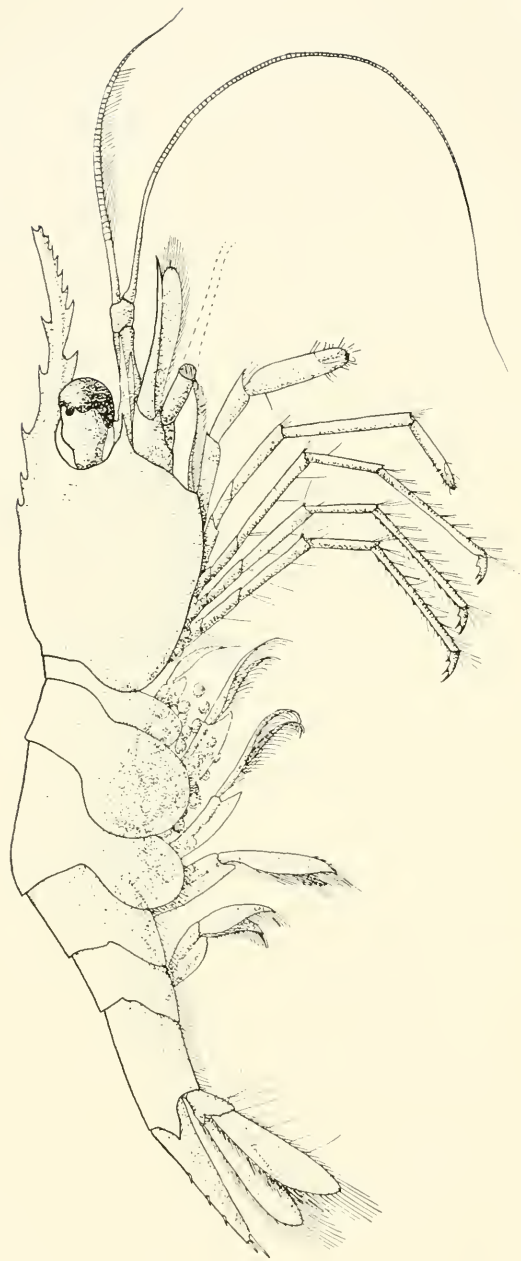
the distal joint of the antennular peduncle. The flagellum is fine, nearly twice the length of the scaphocerite.

The external maxillipeds are slender, pediform, when extended, reaching slightly beyond the antennular peduncle; the distal article is three-fifths as long as the preceding joint, tapered distally. Both joints are fringed with coarse, separately set, long setae.

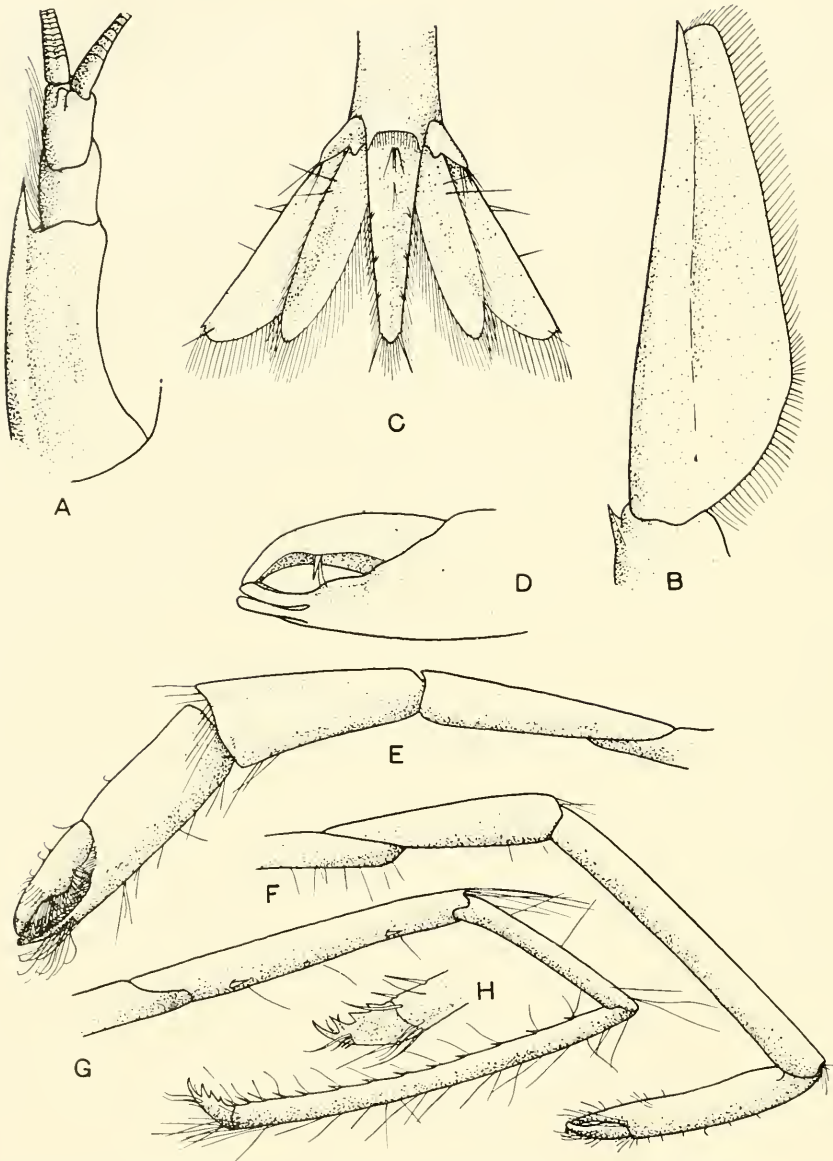
The first pair of legs (female) is subequal, slender, with the ischial joint slender, slightly longer than the merus, or four-fifths as long as the propodus and fingers considered together; the merus is four-fifths as long as the ischium, similar; the carpus is three-fifths as long as the merus, obconic; the palm is similar to the carpus but about one-third longer; the fingers are subequal, as long as the palm, very slender, tapered, with the fixed finger slightly the longer and thicker, it being curiously dorsal in position, its very curved, acuminate tip overlapping that of the slenderer hinged finger, which is also acuminate. The cutting edges are straight, meeting throughout their length, that of the lower finger beset with fine, stiff, sieve-like spinules or setae in regular close formation and opposing a similar series on the margin of the opposed hinged finger.

The second pair of legs is similar to the first, nearly subequal, being only a trifle larger, exceeding the first pair in length by about one-half the length of the fingers of the second pair. There is a long, well developed epipodite on each the first and second pairs of chelipeds, also there is one present on ambulatory legs pairs one and two, while on pair three the epipodite is present but greatly reduced.

The first pair of ambulatory legs is very weak, slender, and has more the appearance of a degenerate swimmeret than of an ambulatory leg. They extend to midway the merus of the second pair of chelipeds. The basis of the first pair of ambulatories is stout and has an acute spine; about 1 mm. long, at the inner distal ventral angle, and supports a slender, setose, tapered, acuminate epipodite, which is 1.9 mm. long; the ischial article is the longest and widest of the series, being 2.5 mm. long, 0.6 mm. greatest width; the ischium has six to eight articulate spines on the inferior lateral margin; the merus is distinctly slenderer than the ischium, 1.5 mm. long, with four to six articulate spines on the inferior margin; the carpus is obscure, scarcely 0.5 mm. long; the propodite



Rhynchocinetes hendersoni Kemp, female, $\times 4$.



Rhynchocinetes hendersoni Kemp, female; A, antennular peduncle, $\times 12$; B, scaphocerite, $\times 12$; C, telson and uropoda, $\times 3$; D, fingers of first chela, setae omitted to show spines, greatly enlarged; E, first cheliped, greatly enlarged; F, the distal four joints of second cheliped, greatly enlarged; G, third leg, greatly enlarged; H, a further enlargement of the dactyl of the third leg, showing dentition.

is weak, 0.9 mm. long; the dactyl is stylet-like, 0.7 mm. long; the distal three articles have curiously the aspect of a typical maxillary palp and are quite setose along the inner lateral margin and a tuft of these setae tip the apex of the dactyl.

The second pair of ambulatories has the basis stout, nearly two-thirds as wide as long; the basis is 0.5 mm. long, with the basephysis about 0.75 mm. long; the ischium is no longer but is as wide, bent, more compressed and bearing on the median portion of the anterior lateral border an oblique, laminate, somewhat dentate process, which is nearly as long as the ischium and extends obliquely outward; the merus is laminate, length 1.1 mm., median width 0.5 mm.; the anterior lateral margin slightly serrulate on the proximal portion and terminating distally in a distinct angulation or tooth; the carpus is elongate, slenderer than the merus, compressed clavate, 1 mm. long; the propodite is 0.6 mm. long, slender; the dactyl is 1 mm. long., tapered, acuminate. The inferior lateral margin of the meral, carpal, propodal and both lateral margins of the dactyl are setose; the dactyl is also "cuffed" proximally with long bristles. The basephysis is present, about one and one-half times the length of the supporting joint, but is distinctly shorter than that of the first pair of ambulatories.

The third pair of ambulatories are similar in shape to the second pair, but weaker, shorter, and differ in that the basis joint has a strong antrorse spine and there is no basephysis present on the third pair of ambulatories. The third pair of legs have the three proximal joints definitely arched, in a manner strongly resembling the arched fifth pair of legs of a typical hermit crab.

Family: **RHYNCHOCINETIDAE**

Genus: **RHYNCHOCINETES** H. M. Edwards

Rhynchocinetes hendersoni Kemp

Plates 28 and 29

TYPE: Dr. Kemp's type series came from Pamban and Kilakarai, Gulf of Manaar, and is deposited in the Calcutta Museum.

DISTRIBUTION: In addition to the type localities, Dr. Kemp has reported this species from Tuticorin and the Fiji Islands. The "Alva" specimen from Bali adds another locality for it.

MATERIAL EXAMINED: An ovigerous female, taken in coral, Temukus Roads, Bali, Dutch East Indies, October 25, 1931.

TECHNICAL DESCRIPTION: Carapace compact, median or greatest height equal to four-fifths of length, sides moderately convex, produced in the median dorsal line to a crest-like rostral carina that arises slightly posterior to halfway the length of the carapace and extends forward confluent with the long, curved rostrum, which is one and one-sixth times as long as the carapace. There are three laterally compressed, acute, procurved spines, the series increasing in size from the epigastric, or proximal spine, forward, the third spine being just above the orbital angle; there is a fourth, subequal spine just in advance of this on the rostrum above the cornea, and a fifth, slightly smaller spine, subequally spaced in advance of the fourth spine. The rostrum is vertically much expanded, with the dorsal margin concave, dipping lower than the carapace carina, and the distal half is directed abruptly upward on a much higher plane than the carapace and has the apex truncate and tridentate; the lower proximal portion of the rostrum is much expanded, with the distal lower portion less so, there being nine teeth on this margin, the proximal four of which are deep, approximately equal, well separated by deep sulci; the first and second of these teeth occur immediately in advance of the eye and are directed nearly straight downward, while the third and fourth teeth are directed obliquely forward, the fifth to ninth teeth, inclusive, have their apices directed nearly straight forward. The acute antennal spine is the only other spine present on the carapace. The frontal margin curves regularly to the weakly subacute anterolateral angle.

The antennular peduncle extends as far as the second rostral tooth, or is three-fifths as long as the scaphocerite; the first article is rectangular, deeply concave dorsally, with the outer distal angle produced into a very acuminate spine, which extends to the base of the third article and which is separated proximally from the main portion of the first segment by a deep, oblique incision; the second and third articles are fleshy, short, subcylindrical, the distal one not deeply cleft; the flagellum is biramose, the upper branch being the thicker, and extending for about one-third its length beyond the rostrum; the lower branch is twice as long as the upper one and very fine.

The antennae have the basal article two-fifths as long as the scaphocerite, with the outer lateral margin thick, terminating distally in an acute spine; the scaphocerite is a little shorter than

the rostrum, extending as far as the seventh inferior rostral spine, or about six-sevenths of the rostral length, with the outer lateral margin thickened, nearly straight, terminating in an acute tooth that extends beyond the distal margin of the inner portion; the inner blade is widest about the proximal fourth, where it is convex, and from which point it narrows distally and is bluntly and very slightly obliquely truncate, the margins are ciliate; the remaining peduncular articles are thick, cylindrical, extending two-fifths of the length of the scaphocerite; the flagellum is broken.

The mandible has the cutting edge dentate; the incisor process is absent; the palp is composed of three joints.

The first legs are apparently equal in the present specimen, an adult female, although the carpal and propodal articles on one are broken off. The ischial joint is produced to a subacute process on the inferior distal margin, extending two-fifths of the lower margin of the merus; the merus is clavate, narrowed proximally, two-thirds as long as the propodus and finger, very slender, with a subacute dorsal denticle distally; the carpus is three-fourths as long as the merus, more substantial, laterally compressed and produced dorsally into a carina, which forms a strong, subdistal acute, triangulate tooth; the palm is much compressed laterally, smooth, as long as the carpus and one-half as high as long; the fingers are three-fifths as long as the palm, meeting only at the tips, which are black, horny, tridentate; the fingers are separated by a wide oval gape; the cutting edge of each finger is a concave trough, distally terminating in three black teeth; there is in this trough, about three-fifths of the length from the base, an acute, black, spine-like tooth, directed straight upward and opposed to a similar tooth from the opposite finger.

The second pair of legs are extremely slender, with the ischium nearly subequal to the merus; the carpus is one and three-fifths times the length of the merus; the propodus, including the dactyl, is two-thirds as long as the carpus; the palm is slender, much compressed laterally, the fingers being one-fourth of the total length, very feeble, meeting throughout their entire length, with the tips black, horny, rounded and fringed with setae.

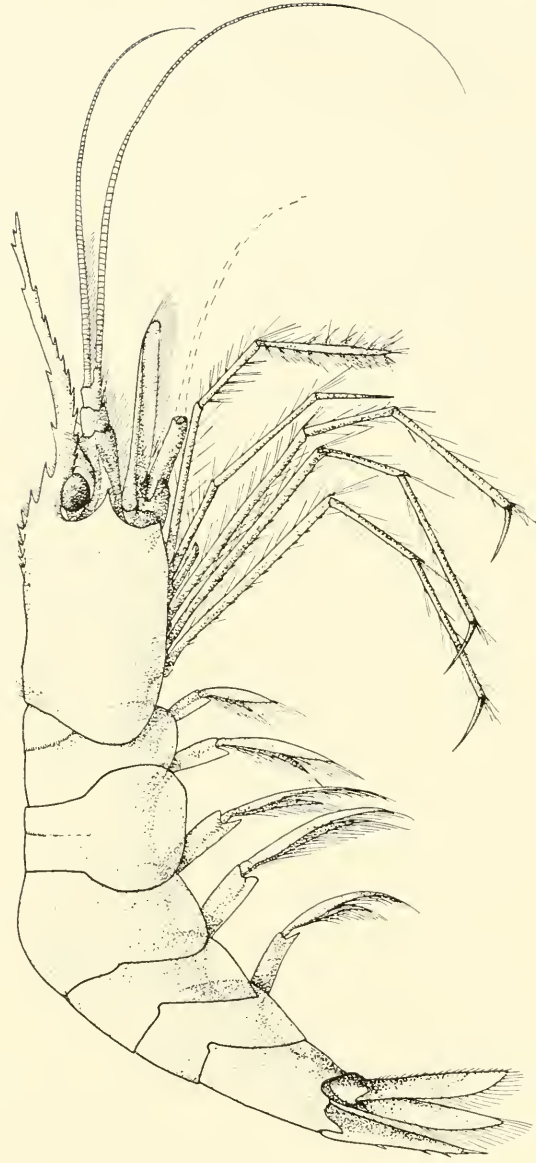
The first, second and third pairs of ambulatory legs are exceptionally slender, thin, stick-like, long, decreasing in length in the order 1, 2, 3. The second right leg measures as follows: Ischium, 1 mm. long; merus, 4 mm. long; carpus, 2 mm. long, and with a

small distal tooth at the upper margin; propodus, 4 mm. long; the dactyl, 0.5 mm. long, tapered, triangulate, biunguiculate, with two to three secondary spinules along the inferolateral margin. The propodus is armed along the entire lateral margin with a series of seven or eight acute, articulate spines.

There are five pairs of biramous pleopoda; each has the peduncular article strong, and both blades large, ovate, ciliated. The specimen carries between 400 and 500 eggs.

The entire surface of the carapace is marked by fine wavy lines in nearly vertical series. Similar lines pattern the abdominal terga, but occur in an approximate concentric, longitudinal arrangement on the median area of the second and third segments and longitudinally on the epimera of these segments, while on the fourth, fifth, sixth segments and the telson the lines again become approximately transverse, fading out on the telson. The third abdominal segment is greatly produced posteriorly in the median region, dorsally convex, hump-like, with the posterior margin forming a median peak, on either side of which it is concave to the epimeral border, which is widely convex. The third segment is one and one-fourth times as long as the sixth segment. The fourth, fifth and sixth segments are bent downward, successively narrowed, the fourth and fifth segments being approximately subequal, with the posterior margin notched in the median lateral line and the postlateral angle produced, acute; the sixth segment is one and four-fifths times as long as the fifth, or four-fifths as long as the telson and produced to an acute triangle above the base of the telson and a smaller angulation at the outer base of the uropod. The telson has the posterior margin narrowed, nearly truncate, a very little rounded, with a pair of small submedian spines, and outside of these a pair of long, articulated spines, with a few long hairs interspersed from the under margin; on the dorsal surface there are four pairs of articulated spines in longitudinal series, the fourth pair of which is subdistal. The uropod peduncle is unequally bidentate distally, the larger triangle occurring above the base of the outer lobe; both blades are narrowly ovate, each a little longer than the telson, with the distal margins regularly setose; the outer blade has a subdistal tooth on the outer lateral margin.

The eye is quite large, the cornea hemispherical, deeper and larger than the stalk, upon which it is set obliquely terminal, the



Plesionika bioeulalis (Bate), $\times 22$.

deeper corneal face being frontolateral; a large, circular ocellus is on the median dorsal corneal margin adjacent thereto, but distinct from the cornea.

REFERENCE: *Rhynchocinetes hendersoni*, KEMP, S., Records Indian Mus., vol. XXVII, 1925, p. 265, figs. 3-7.

Family: PANDALIDAE

Genus: PLESIONIKA A. Milne Edwards

Plesionika binoculis (Bate)

Plate 30

TYPE: The "Challenger" secured the type at Station 190, in the Arafura Sea, south of New Guinea, Lat. $8^{\circ} 56' S.$, Long. $136^{\circ} 5' E.$, depth 49 fathoms, September 12, 1874, and it is deposited in the British Museum of Natural History.

DISTRIBUTION: In addition to the type locality, the "Siboga" secured this species at Station 302, Lat. $10^{\circ} 27.9' S.$, Long. $123^{\circ} 28.7' E.$, in the strait between Rotti and Timor, depth 216 m.; also at Station 306, Lat. $8^{\circ} 27' S.$, Long. $122^{\circ} 54.5' E.$, Lobetobi Strait, between the islands of Flores and Solor. The "Alva" specimen also comes from near Flores Island.

MATERIAL EXAMINED: One specimen, about 60 mm. long, dredged in 140 fathoms, in Flores Strait, near Larantuka Village, Flores Island, Dutch East Indies, October 22, 1931.

TECHNICAL DESCRIPTION: The "Alva" specimen, which is not quite so large as the largest of the "Siboga" series, is perfect, except that the second pair of legs are missing. It measures about 60 mm. long; the rostrum, from orbital angle to tip, being a decided curve, of which the straight line is 18 mm., the carapace is 12 mm. long; the abdominal segments total 30 mm., of which the telson is 12 mm.

The carapace is finely setigerous, compact, with a very faint median carina arising slightly beyond the posterior margin and bearing two small, rudimentary, linear-like, acute teeth on the posterior third of carapace, the median area being smooth, the prerostral carina arising on the anterior third of the carapace as a sloping crest, and bearing five articulated, increasingly larger, sharp, procurved teeth, equally spaced, the anterior one being just posterior to the orbital angle; beyond these there are above

the orbit two subequal, more widely separated, fixed, acuminate, subequal teeth, the anterior of which projects the tip a little beyond the orbit; the rostrum curves downward abruptly just beyond this spine, and anterior to the eye, runs forward for a short distance, bearing one small spine, which is about one and a half times as far from the preceding spine as the latter is from its predecessor; thence the rostrum curves decidedly upward, the distal two-fifths being obliquely much higher than the highest prerostral crest of the carapace. Beyond this small spine (third of the fixed series, or eighth of the entire series) there are five more similar spines, the proximal four of which are also widely separated from each other and approximately subequal; the fifth spine is similar to the preceding one, subapical in position, being midway between its predecessor and the acute apex. The inferior rostral margin is armed with thirteen small, acute teeth, the proximal of which is just anterior to the distal margin of the eye, the distal tooth being opposite the third from apex tooth of the superior margin. The postorbital tooth is acuminate; the anterolateral angle is blunted. The abdominal segments are compact, the posterior margin of the third segment being moderately produced in the median dorsal region but not dentate; the sixth segment is five-sixths as long as the telson and has the posterior margin produced on either side in the median lateral area into an acute triangle that projects above the telson. The telson is somewhat rounded dorsally, decidedly tapered posteriorly, the distal margin very narrowed and ciliated. There are three pairs of articulated, submedian spines on the dorsal surface. The uropoda are well developed.

The eye is large, bulbous, hemispherical, set upon a short, obconic stalk.

The antennulae have the basal article elongate-laminate, concave beneath the eye, distally curved upward in advance of the eye and fringed with bristly setae; there is also an outer lateral process to this first article; the second and third articles are cylindrical, successively shorter; the flagella are respectively one and four-tenths and one and eight-tenths times as long as the rostrum and both are exceedingly fine on the distal halves.

The antennae have the basicerite short, strong, with sinuate distal margin; the second and third articles short, cylindrical, the third article extending as far as the second peduncular article

of the antennulae; the flagellum is very fine, broken. The scaphocerite is half as long as the rostrum, elongate, widest on the proximal half, with the inner lateral margin convex, crenulate, ciliated, narrowing distally toward the evenly convex distal margin; the outer lateral margin is straight, slightly thickened, terminating in a small, acute tooth that extends not quite so far as the ciliated convex, distal margin.

The external maxillipeds are pediform, extend to midway the length of the third pair of legs, are subcylindrical, as wide as, and stouter than, these legs and are beset with spinose bristles in tufts on the distal two joints; several very strong bristles are present on the apex.

The first pair of legs are distinctly the shortest of the series, being not quite so long as the external maxillipeds; with the dactyl much elongated, slightly more than half as long as the related propodus, very tapered, acuminate, stylet-like, the tip being furnished with a small series of curved, hook-like spines in graduated series, the shortest ones being nearest the tip.

The second pair of legs are unequal, with multiarticulate carpal joint and weakly chelate. (These legs are missing in the present specimen.)

The third, fourth and fifth pairs of legs are subequal, quite long, and exceedingly slender, each with the inferior lateral margins of the meral, carpal, and propodal articles and proximal half of the dactylar articles, beset with a series of articulate spines. The various joints are reinforced; the dactyli are each about one-third as long as the related propodi and are very slender, curved, acuminate.

REFERENCES: *Nothocaris binoculis*, BATE, C. S., Rept. H. M. S. "Challenger," Zool., Macrura, vol. XXIV, 1888, p. 656, pl. 114, fig. 2.

Plesionika binoculis, DE MAN, J. G., "Siboga"-Expeditie Decapoda, pt. 4, Monogr. 39a-3, 1920, p. 134, pl. 12, fig. 30.

Genus: PARAPANDALUS Borradaile

Parapandalus serratifrons Borradaile

TYPE: The type series of seven males was secured by Dr. Willey, in 50 to 100 fathoms, Blanche Bay, New Britain, and is deposited in the British Museum.

DISTRIBUTION: Blanche Bay, New Britain, 50 to 100 fathoms; D'Entrecasteaux Group, New Guinea (Borradaile); "Siboga," Station 306, Lobetobi Strait, 247 m.; "Siboga," Station 312, Saleh Bay, north coast of Sumbawa, depth 274 m. (de Man); Bima, Sumbawa Island (Boone).

MATERIAL EXAMINED: One specimen, about 20 millimeters, long, taken at Bima, Sumbawa, Dutch East Indies, October 23, 1931, by the "Alva"; depth not cited. Other specimens from this station all shallow water records.

REMARK: Mr. Borradaile notes that this species forms a part of the food of the pearly nautilus.

TECHNICAL DESCRIPTION: The single specimen obtained by the "Alva" appears to be the first record of the species since the type series was captured, and very substantially extends the southern distribution of this most primitive genus of the *Pontoniinae*.

The Sumbawa specimen has the rostrum about twice as long as the carapace, slender, compressed laterally, recurved, the portion just beyond the orbit dipping concavely, the distal half thrust decidedly upcurved, both dorsal and ventral margins dentate, the formula being $\frac{13}{12}$, the distribution on the dorsal margin beginning on the epigastric region, where there are four spines, succeeded by two, the largest of the series, on a crest above the orbit, followed by four small teeth in series above the antennulae next to a non-dentate area, and there are three small separated teeth near the tip, the thirteenth tooth being subdistal. The twelve ventral teeth are nearly subequally spaced, the most proximal one being just in advance of the cornea, the terminal one, at the apex. The carapace is smooth, rather compressed, slender, the antennal spine present, slender; the hepatic spine small, acute, nearly branchiostegal in position. The abdominal segments are rather compressed, the first to third, with the lateral margins deep, convex; the third segment is produced to a median dorsal point posteriorly; the fourth to sixth segments decrease in breadth; the sixth segment is elongated, one and one-half times the length of the fifth segment or three-fourths as long as the telson. The telson is slightly shorter than the uropoda and is quite narrowed and tapered, the dorsal surface channelled in the median line and margined on either side dorsolaterally by a longitudinal ridge. These ridges bear three pairs of articulated spines, the proximal pair being placed little more than one-third of the telsonic length from

the proximal margin; the second pair being about halfway the telsonic length; the third pair being halfway between the second pair and the telsonic distal margin. The telson terminates in a shallow triangulation armed with a submedian pair of elongate, acuminate spines, a few long bristles and an outer pair of small, articulate spines, one each being at the outer distal lateral angle of the telson, these spines being in line with those of the dorsal series. The uropoda have the inner blade quite narrow throughout its length, and distally the lateral margins converge to a narrowed, slightly rounded apex. The outer blade is somewhat wider and a little longer than the inner one, with its outer lateral margin definitely thickened, defined on the inner side by an oblique carina and terminating in an acute, subdistal spine; a curved transverse suture extends inward opposite this tooth; the inner distal portion of the blade is rather regularly convex; both blades are ciliated.

The eye is quite large, set upon a short obconic stalk which has less depth than the large hemispherical black cornea, which bears an ocellus adjacent to the dorsal margin and has a diameter equal to one-third of the length of the carapace.

The antennular peduncle is only one-third as long as the rostrum, or scarcely three-fourths as long as the antennal scaphocerite; the first article is not quite as long as the second and third articles considered together, with the stylocerite and distal spine small; the second article is a trifle shorter than the third; the outer flagellum is deeply cleft, the inner branch slenderer, both are one and one-half times as long as the rostrum.

The antennae have the basicerite armed with a small spine; the scaphocerite not quite one-half as long as the rostrum, its median width nearly half its length, slightly outcurved, with the lateral margin slightly convergent, the outer one terminating in a subdistal spine. The distal margin of the major or inner portion of the blade is curiously bluntly truncate. The carpocerite is cylindrical, extending nearly halfway the length of the scaphocerite; the flagellum is broken off.

The third maxillipeds extend not quite as far forward as does the rostrum and are slender, subcylindrical, yet much stouter than the first pair of legs and with the distal article armed along its inferior side with a series of sharp spinules, interspersed with setae; on the distal margin these spines are clustered and much stronger and curved.

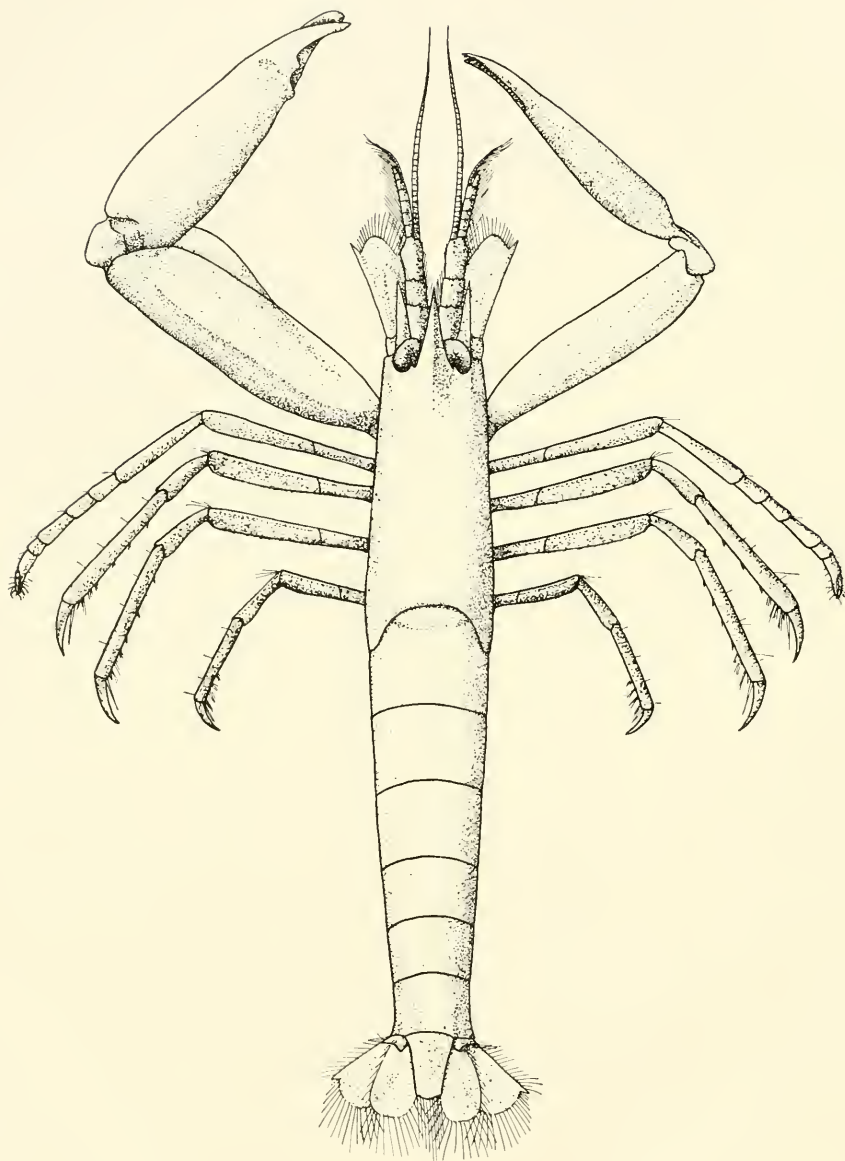
The first pair of legs are monodactyl, very slender, extending almost as far forward as do the third maxillipeds, and having the dactyl very long, stylet-like, acuminate, and armed on both lateral margins with a series of minute spines, the tip with a tuft of spines.

The second pair of legs are chelate, with multiarticulate carpus, which consists of seventeen articles, of which the first and seventeenth are longer, the first being equal to the next four articles considered together; the second to sixteenth articles, inclusive, being quite small subequal; the seventeenth article is about two-thirds as long as the first article, or three-fifths of the length of the palm; the carpus is armed along the upper and lower lateral margins with a series of small, acute, obliquely-set spinules, one on each side of an articulation; the propodus has a total length of 2 mm.; of this the palm is 1.4 mm., the finger 0.6 mm.; the fingers are subequal, slender, meeting throughout their length, their tips are curved and beset on the outer surface with a series of small bristles.

The third, fourth and fifth pairs of legs are similar, exceedingly slender, the third pair extending beyond the second pair by about half the length of the related longer propodus and dactyl. The third leg has the ichium 1.6 mm. long; the merus 5 mm. long; the carpus 2.5 mm. long, 0.4 mm. wide; the propodus 4 mm. long, 0.4 mm. wide; the dactyl 1 mm. long, curved, with an acuminate tip. The meral, carpal, propodal and dactylar joints, inclusive, have the inferior lateral margin armed with a series of small spinules. There are no epipodites visible on any articles.

REFERENCES: *Pandalus* (*Parapandalus*) *serratifrons*, BORRADAILE, L. A., in Dr. Willey's Zool. Results Based on Material from New Britain, New Guinea, Loyalty Islands and Elsewhere, 1895-1897, pt. 4, 1900, p. 411, pl. 37, figs. 8a-d.—DE MAN, J. G., "Siboga" Expeditie.—Monogr. Livr. 87, 39a-3, 1920, p. 146, pls. 12-13, figs. 34-34e, Leiden.

Pandalus Parapandalus tenuipes, BORRADAILE, op. cit., p. 412, pl. 37, fig. 9.



Athanas djiboutensis Coutiere, $\times 7$.

Family: ALPHEIDAE

Genus: ATHANAS Leach

Athanas djiboutensis Coutiere

Plate 31

TYPE: M. Coutiere's type was collected in Djibouti, East Africa, and is deposited in the Paris Museum.

DISTRIBUTION: This species appears to be rather rare, having previously been recorded only four times, but from widely distributed localities: Djibouti, East Africa (Coutiere); Funafuti Atoll, Ellice Islands (Borradaile); Rikitea (Nobili); Naifuro Reef, Hulule, Malé Atoll, Minikoi Island, reefs and lagoons (Coutiere); Anaho Bay, Nuka Hiva, Marquesas Islands (Boone).

MATERIAL EXAMINED: Two specimens, a male and a female, collected in coral reef, at Anaho Bay, Nuka Hiva, Marquesas Islands, August 10, 1931, by the "Alva."

TECHNICAL DESCRIPTION: Viewed dorsally, the rostrum is an elongated, acuminate triangle with the apex extending as far as the distal margin of the second peduncular article; it does not have the obtuse angulation opposite the outer margin of the eye, as shown in Coutiere's figure of the Minikoi specimens. The lateral rostral margin of the present specimen is an uninterrupted oblique line; the supracorneal spine is small, short, separated by a small V-like notch from the rostrum projected forward above the eye for a distance only half so long as the infracorneal spine extends, the latter being closely appressed to the lateral surface of the cornea and extending two-thirds of the corneal length, being slightly shorter than the inferior angulation of the carapace below the orbit, which is seven-eighths as long as the cornea, in this respect agreeing with the profile figure 129b of M. Coutiere, which shows the lower infraorbital angulation to be the longer and larger, which is also true in the present Marquesas Islands specimens. Below the inferior orbital angle the margin slopes gradually to the anterolateral border. The carapace is dorsally quite narrow, much compressed laterally; including the rostrum, it is about two-thirds of the total body length. The abdominal terga are smooth, dorsally rounded, the first, second and third segments subequal; the fourth and fifth segments subequal, but each a little shorter than the third segment; the sixth segment not quite one and one-half times as long as the fifth; the telson 1.2 times as long

as the sixth segment, dorsally smooth, slightly convex from side to side; lateral margins convergent, distal margin shallowly rounded; dorsal surface with two submedian pairs of articulated spines in longitudinal series; the proximal pair being about half-way the length of the telson and very close to, yet above, the lateral margin; the second pair of spines are half-way between the first pair and the distal margin. The uropoda have a small peduncle; the ovate, nearly subequal blades extend beyond the telson for almost the distal third of their length. The outer blade has a small, subdistal tooth on the outer lateral margin; both blades are rounded evenly distally and finely ciliated.

The eye is large, ovoidal, the proximal third semiconcealed beneath the close hooding carapace; the facets are coarse, numerous; the distal margin of the eye reaches almost as far forward as the distal margin of the first peduncular article of the antennules.

The antennular peduncle exceeds the length of the rostrum by about the length of the distal article; the flagella are fleshy, tapered, of nearly subequal length, each about one and one-third times as long as the peduncle.

The antennal peduncle is only as long as the first two articles of the antennular peduncle, but the scaphocerite extends slightly beyond the distal margin of the antennular peduncle. The scaphocerite is lobate-acuminate, the inner lateral margin more convex proximally than the outer, the acuminate tip extending almost as far as the distal margin of the second peduncular article of the antennulae; the outer lateral margin of the scaphocerite terminates in a small, acute, triangulate tooth; the distal margin is evenly, rather broadly convex and ciliate. The antennal flagellum is moderately stout proximally, about twice as long as that of the antennulae.

The chelipeds are markedly unequal in both sexes. The male right cheliped is the smaller; the ischium is small, slender; the merus with the outer lateral surface nearly oval, narrowed proximally and distally but with the median three-fourths, about two-fifths as wide as long; the inferior surface excavate for the reception of the reflexed propodus; the carpus is shorter than the fingers, node-like, with the upper, outer angle nearly right-angled, knob-like; the propodus is curiously twisted, trigonal, with the thickest area occurring about two-fifths of the length from base, narrowed distally; the propodus is about as long as the

merus, fingers about two-fifths as long as the palm and bent distally, very curved; cutting edges meeting, tips slightly overlapping. The great cheliped is larger than the smaller one in the ratio shown in Plate 31; the most conspicuous difference being in its more dilated aspect. The merus is as long on its upper margin as is the carapace, exclusive of rostrum; the upper meral surface is linear, slightly rounded distally because of the curvature with the inner lateral surface; the outer lateral surface is approximately a wide flattish oval, its greatest width being about one-half of the meral length; the upper lateral margin is moderately convex in profile; the lower lateral outer margin is more convex distally than proximally and much more so than the upper margin; the ventral-meral surface is excavate for the reception of the reflexed carpus and propodus; the carpus is short, little more than half as long as the finger, dorsally very convex; the propodus is 3 millimeters long, or as long as the carapace, including the rostrum, and is moderately dilated, its greatest width or thickness being near the proximal end and being about equal to one-third of the total length of the propodus and finger; the upper, or outer surface of the palm is quite convex, and distinctively, irregularly tapered; the propodal finger is short, not quite one-third of the total length of the palm, and distinctively down-curved in its entire length and also with the tip portion curved inward, the tip acuminate, jutting beyond that of the upper finger; the upper finger appears more curved than the lower one, fitting closely upon the opposed cutting edge and is a little slenderer with the acuminate tip a trifle shorter than that of the related lower finger. The female specimen lacks both first chelipeds. An excellent description, with figure of these, is given by M. Coutiere.

The second pair of legs are subequal to each other. The left leg is very slender and measures: ischium, 0.9 mm. long; merus, 1.1 mm.; carpus: first article, 0.7 mm.; second article, 0.2 mm.; third article, 0.2 mm.; fourth article, 0.25 mm.; fifth article, 0.5 mm.; propodus: palm, 0.5 mm.; fingers, 0.45 mm. each, very slender.

The third pair of legs are quite slender, about one and one-fourth times as long as the carapace; the ischium is 0.5 mm. long; the merus, 1.1 mm. long; the carpus, 0.45 mm. long, with a small distal dorsal spine; the propodus is 1.5 mm. long and is 0.4 mm. at

its widest point; the dactyl is 0.5 mm. long, very curved, tapered, unispinose.

The fourth and fifth pairs of legs are similar to the third pair but are successively shorter by about the length of a dactyl.

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Athanas sulcatipes, BORRADAILE, L. A., Proc. Zool. Soc. London, 1907, p. 1011, pl. 65, fig. 9.

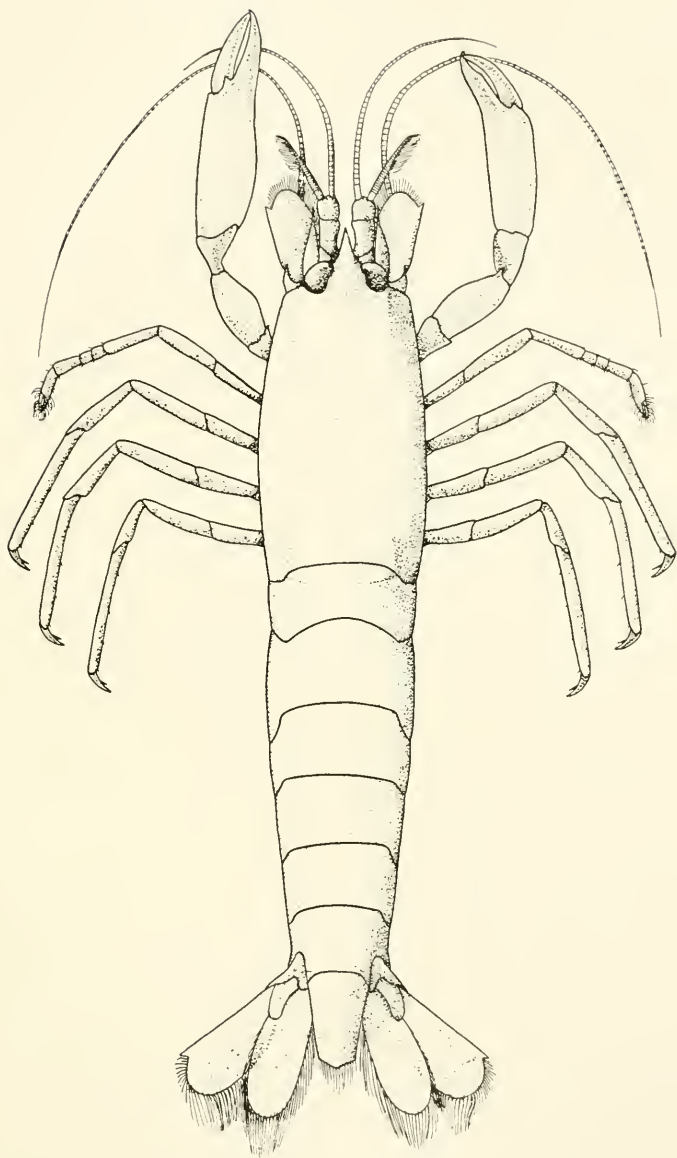
Athanas gracilis new species

Plate 32

TYPE: The type and only specimen known was taken in coral at Teviatea Reef, Raiatea Island, Society Islands, August 21, 1931, by the "Alva."

DISTRIBUTION: Restricted to the type locality.

TECHNICAL DESCRIPTION: Carapace about 15 mm. long, glabrous, very finely punctate, with the rostrum, viewed dorsally, a proximally wide triangle, only microscopically separated from the supraorbital tooth and with the rostral apex acuminate, projecting beyond the margin as far as the distal margin of the second peduncular article of the antennulae; viewed in profile, the rostrum is seen to be concave ventrally with the extreme apex tapered from both dorsal and ventral-lateral margins to a point. The supracorneal spine is rudimentary. The infracorneal spine is represented by the distinct, acuminate apex of the closely appressed inferior corneal angle of the frontal margin of carapace. The spine apex is about midway the longitudinal diameter of the black cornea and is distinctly weaker than that figured for *Athanas nitescens* Leach, by Heller and Bate, respectively, and the frontal margin of *A. gracilis* between the infracorneal spine and antennal angle is scarcely concave at all, while that of *A. nitescens* is figured as decidedly concave; also the antennal angle is bluntly truncated, not pointed. The small, supracorneal tooth is closely appressed to the orbital border, the apex reaching almost midway



Athanas gracilis Boone, type, greatly enlarged.

the cornea. This tooth is more obscure in *A. gracilis* than is that of *A. naifaroensis* Coutiere, but is also distinctly defined, therefore not to be confused with *A. nitescens*. In the present species, the tooth is separated from the rostrum by a small, acute incision, the "tooth" being closely appressed to the rostrum and the incision nearly linear. The small supraorbital tooth is absent, there being only a slight pinching in, or crease, in the carapace defining the base of the rostrum from the orbital border, which presents an uninterrupted concave margin, not even possessing that "more or less obtuse prominence" that de Man accredits to *nitescens*.

The cornea is large, ovoidal, closely encupped by the carapace margin, the distal corneal margin extending about one-half of the length of the dorsally visible portion of the first peduncular article of the antennulae.

The antennulae are thick and have the first article extending two-thirds of the length of the rostrum; the second article extending as far as the apex; the third article is about one and one-half times the length of the second article, and reaching as far forward as does the scaphocerite; the flagellum is fleshy, composed of ten articles and a terminal stylus; the inferior margin bears a coarse brush of setae; the inferior whip is slenderer, about twice as long as the other one; the stylocerite is a long, narrowed, acuminate triangle, the apex of which extends to midway the third article of the antennular peduncle.

The antennae have a strong basal article, which has the outer distal margin in profile with two pointed lobes, one above, and the longer apex below the scaphocerite; the second and third articles are cylindrical, thickened, considered together, are as long as the scaphocerite and also equal in length to the antennular peduncle; the flagellum is fine, about as long as the body. The scaphocerite is short, about three-fourths as wide as long, with the outer distal angle a sharp tooth, the distal and inner lateral margins convex, ciliate.

The abdominal terga are moderately rounded dorsally, with the lateral margins overlapping, not much produced, forming an almost unbroken line along their lateral margin, which is only projected about two-fifths of the length of the pleopodal peduncle beyond the ventral wall. The first abdominal segment is the shortest; the second segment is one and one-third times as long as the third segment; the third to sixth segments, inclusive, are approxi-

mately subequal; the telson is about one and one-half times the length of the sixth segment, the telson being 1.5 mm. long, dorsally smooth, very little rounded toward the lateral margins, which are convergent distally; the distal margin is nearly truncate, very slightly rounded at the outer angles; there are two pairs of articulated spines, one spine of each pair being on either side of the lateral margin, the proximal pair being about two-fifths of the telson's length from its base, directly on the lateral margin, the second pair of spines being in line with and about half-way between the first pair and distal margin; there are no spines on the distal angles; the distal margin is setose. The uropoda are about one-fourth times longer than the telson; the peduncle with a broad, evenly rounded lobe above the base of the two branches; the outer branch is equal in length to, but slightly wider than, the inner branch; this outer branch also has its outer lateral margin terminating in an acute, subdistal tooth, with a tranverse, oblique suture running inward from this point. The distal margins of both blades are evenly, unequally rounded and fringed with long, web-like setae. All five pairs of pleopoda have a very substantial, long peduncle; the first pair have a rudimentary, thread-like inner blade and a medium size outer blade which is narrowly ovate distally with setose margins.

The chelipeds are subequal, directed forward, the basis slender, longish, laterally compressed; the ischium is also laterally compressed, narrowed proximally, widened distally, the outer and inner distal angles encupping the base of the merus; the merus is comparatively short, length 2 mm., greatest width 1 mm., the inferior distal angle a small, rounded node isolated by a small incision from the main portion; the carpus is 1 mm. long, proximally narrowed, widening distally; the distal margin being 1 mm. wide, evenly truncated; the propodus, including the fingers, is about 3.2 mm. long, the palm is 2.5 mm. long, with the upper surface moderately rounded, the lateral margins being nearly subparallel; both fingers are curved inward, with the opposing apices of the chelipeds touching; the propodal finger is slightly the shorter and thicker, with the cutting edge channelled, the outer margin of the cutting edge microscopically serrate; the upper finger is very slender, curved distally, with the apex pointed, overlapping that of the lower finger; the cutting edges meeting.

The second pair of legs is subequal. The second left leg is very

slender; the ischium being slender with a pointed tooth at the upper outer distal margin; the ischium is 0.53 mm. long; the merus is very little longer, 1.1 mm. long; the carpus: first joint, 1.6 mm. long; second joint, 0.95 mm.; third joint, 0.25 mm.; fourth joint also 0.25 mm.; fifth joint, 0.5 mm. long. The propodus is 0.9 mm. long, the palm being 0.5 mm. and the finger 0.4 mm. long, very tapered, with clusters of fan-wise bristles at the tip.

The third pair of legs is slender, when extended, reaching about as far as the proximal portion of the fingers of the first pair of chelipeds; the basis is short; the ischium is 1 mm. long; the merus is flattened, 2 mm. long, 0.7 mm. wide; the carpus is 1 mm. long, rounded, wider distally and with one strong spine on the upper distal margin; the propodus is 2 mm. long, laterally compressed, narrowed slightly proximally and distally, with about nine, small, sharp, articulated spines set subequally along the inferior lateral margin; the dactyl is 0.6 mm. long, very curved, with an acuminate, unguiculate tip; about midway the inferior lateral margin there is one small, articulated spine so placed that it could easily be mistaken for the second point of a bifid dactyl. The fourth and fifth pairs of legs are similar to the third pair, but each pair is respectively shorter by about the length of its dactyl than the preceding pair.

REMARKS: The present species, *Athanas gracilis* Boone, is superficially very similar to the tropic Atlantic species, *A. nitescens* Leach and its variety, *veloculis* Bate, which is known from the Christiana Fjord (Lat. 60°) to the Cape Verde Islands, inhabiting the coasts of England, France, the Hispanic peninsula and the Mediterranean and Adriatic Seas. Pearson (1905) records *nitescens* from Cheval Paar, Gulf of Manaar, but I am inclined to think that his specimen may be identical with the one here described.

Athanas gracilis Boone belongs to the "*nitescens* group" of Coutiere and de Man but differs from *A. nitescens* in:

(a) The rostrum has a different length ratio to the orbit; the supracorneal spine is wanting, and the infracorneal spine in *gracilis* is different from that cited by Heller and Bate, respectively, since in *gracilis* it reaches only midway the cornea and there is no antennal tooth present here, such as figured by Bate.

(b) The antennular peduncle, antennal peduncle and scaphocerite are all three subequal in length in *gracilis*.

(c) The proportionate lengths of the articles of the multi-articulate carpus of the second pair of legs of *gracilis* are also distinctive from that figured by Bate for *A. veloculis*.

Mr. Bate states that the carpus of the first legs of his specimen, *A. veloculis*, is longer than that of the more northern European *A. nitescens* Leach. Perhaps his species should retain full specific rank.

(d) The carpus of the first pair of legs of *A. gracilis* (female) is only as long as its related distal border is wide, while that of *nitescens* is stated by de Man to be twice as long as the distal border. The merus of the cheliped is less than two-thirds as long as the chela in the present species.

Genus: **ALPHEUS** Fabricius

Macrochirus Group, ss. Coutiere

Alpheus ventrosus H. M. Edwards

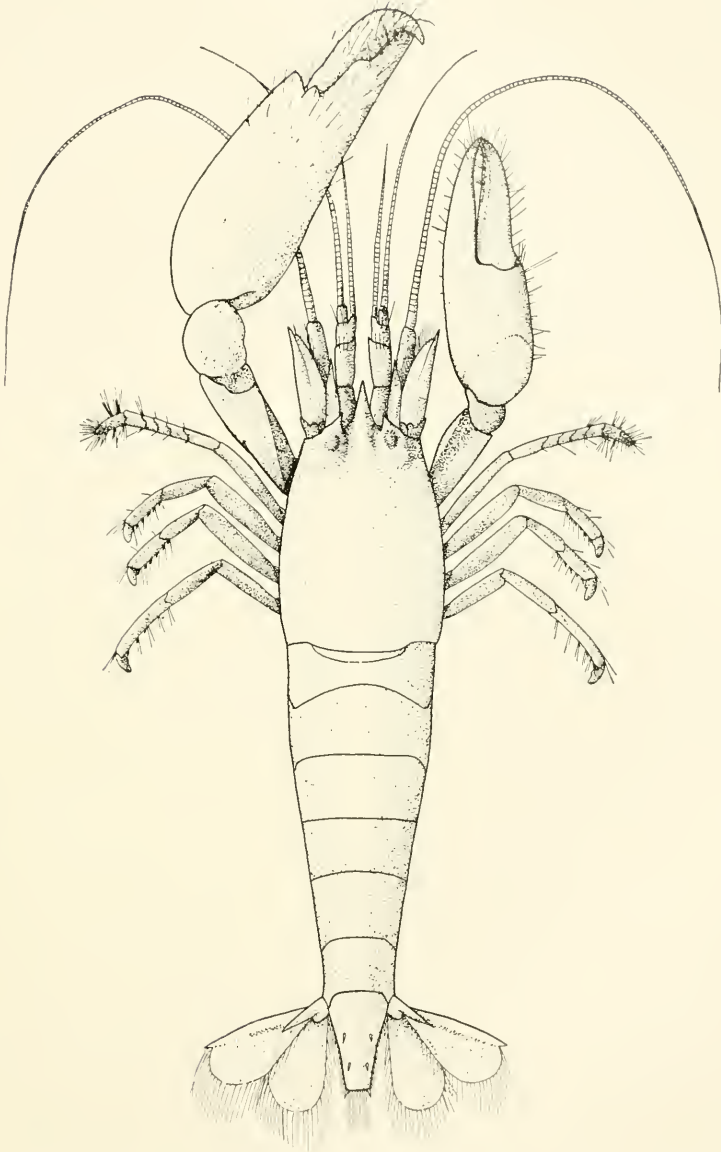
Plate 33

TYPE: Dr. Milne Edwards' type came from the coasts of the Ile de France (Mauritius), and is deposited in the Paris Museum.

DISTRIBUTION: This species is rather widely distributed from the Red Sea southward to Mauritius and eastward through Polynesia to the South Central Pacific. It has been reliably recorded from: Red Sea, Massaouah (Nobili); Mauritius (Edwards); Maldivé Archipelago, Murray Island Reef, Torres Straits (Coutiere); Marquesas Islands (Boone); Palmyra Island (Edmondson); Society Islands (Boone).

MATERIAL EXAMINED: Fifteen specimens from Venus Point Reef, Tahiti, Society Islands, August 15, 1931. Seven specimens, in coral, Teviatoa Reef, Raiatea Island, Society Islands, August 21, 1931. One specimen, in coral, Anaho Bay, Nuka Hiva Island, Marquesas Islands, August 10, 1931.

TECHNICAL DESCRIPTION: The twenty-three specimens taken by the "Alva" present a most interesting series of development, some of the smallest specimens being about 8 mm. body length while the longest one is 37 mm. long and various stages between these two are represented. In the young specimens the ocular spines are frequently absent, or when present are only short, minute points. In the larger adults these ocular spines in-



Alpheus ventrosus H. M. Edwards, $\times 4.25$.

crease in length. Another item of conspicuous difference is to be found in the fingers of the largest cheliped, those of the young specimens being uniformly blunt-tipped, but possessing identical curvature and dentition as the chelipeds do in larger specimens. In a specimen having the propodus of the great chela 5 mm. long, the related carapace is only 2.5 mm. long, so that even in very young adults the great cheliped appears as large or slightly larger than the body. A large male, about 30 mm. body length, has the great cheliped 26 mm. long, 7 mm. high. The chelipeds and body are both greatly compressed laterally. The body is compact, rounded dorsally; the carapace is short, the length, including the rostrum only about 2 mm. greater than the height of one side of the carapace. The rostrum is an acute narrow triangle with the apex produced as far forward as the first peduncular article of the antennae and separated on each side from the orbital lobes by a deep sulcus, which extends back as far as the base of the orbital lobe. The orbital lobes are moderately large, convex, produced distally into an acuminate short spine, which may vary from rudimentary in young adults to an acute spine, about 1 millimeter long in the present large adult, in this instance extending beyond the frontal margin.

The abdominal terga are compact, glabrous, much compressed laterally, and have the epimeral region produced, forming side-walls for a very capacious brood pouch in the females. The telson is one and one-half times as long as the sixth segment, distally rather widely truncate and slightly rounded, setae-fringed; the dorsal telsonic surface is set with three pairs of telsonic spines, subequally spaced in longitudinal series, each line about half-way between the median dorsal line and lateral margin, the third pair of spines being distal. The uropoda are only slightly longer than the telson, with the peduncle produced to a strong triangulate tooth above the base of the outer blade; the inner blade is smaller, oval, evenly rounded distally; the outer blade has a strong subdistal tooth on the outer lateral margin, the distal margin rounded; both blades are heavily setose.

Antennulae with the first peduncular article about 1 millimeter longer in the dorsal view than the rostrum; the second joint about one-fifth longer than the first joint; the third joint slightly more than half as long as the second joint, the entire antennular peduncle not as long as the scaphocerite by a distance equal to the

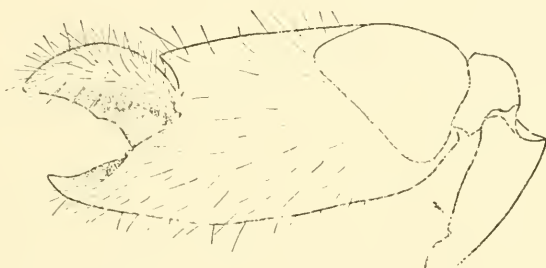
length of the third peduncular article. The flagellum has the shorter, thicker branch about three-fourths as long as the peduncle. The longer, slenderer branch is twice the length of the short one. The antennal scale is lanceolate-acuminate with its triangular apex projecting outside of the second peduncular article for about one-third of its length.

Antennae with the peduncular joint produced to an acute tri-angulate point beneath and supporting the scaphocerite; the second article is very short, subcylindrical; the third article elongated, cylindrical, extending to the distal spine of the scaphocerite; the flagellum is nearly one and one-half times as long as the carapace. The scaphocerite is stylus-like, with the outer portion thickened, apex acute, separated on the inner side by a slight incision from the narrowed, slopingly rounded inner portion; this latter becomes wider toward the proximal end and is fringed distally and laterally by long setae.

The external maxillipeds are pediform, the opposing halves being obliquely appressed, with the inner lateral margin very setose; the distal article tapered, extending definitely beyond the peduncle.

The lesser great cheliped is the longer; has the ischium small, cup-like, supporting the merus, which is trigonal, excavate on the ventral or lower face; the outer lateral surface small, distal margin rather deeply excavate for the reception of the rounded end of the carpus; the upper margin of the merus is produced distally to a slight point above the distal excavation; the carpus is short, very convex on the upper and outer surface and produced to a small point at the upper inner distal angle; on the lower part of the carpus, outside and below the convex portion, and separated from it by a sulcus, is an area which bears a strong median constriction and the portion anterior to this is produced into a laminate support for the lower proximal part of the palm. The propodus, including the fingers, is one and two-thirds times as long as the carapace and the palm is three-fifths of this total length, laterally compressed, yet moderately thick, the greatest height, which is across the proximal portion, is two-fifths of the palm length; the upper proximal portion is produced backward into a rounded node; the upper and outer lateral surface of the proximal area circumscribed by a distinct groove. The upper distal margin of the palm is abruptly truncated above the base of the

finger; the lower finger is thicker proximally than the upper with decidedly upcurved acuminate tip overlapping on the outer side of the tip of the upper finger. The cutting edge of the lower finger is channelled, beset with tufts of bristles; the outer distal surface also bears bristles. The upper finger is slender, similarly tipped, the apex overlapping on the inner side of that of the lower finger, the cutting edge channelled. A slight oblique gape is present between the two fingers. Both fingers are beset with bristles in the channelled cutting edge; the upper finger is also abundantly beset with bristles on the distal half of the outer and lateral surfaces and somewhat less so proximally.



Text figure 9—*Alpheus ventrosus* (H. M. Edwards), sketch of open cheliped, showing tooth; from a different specimen than that shown in plate 33.

The larger great cheliped is approximately five-sixths as long as its companion, with the meral and carpal margins similar, except that the merus is more deeply excavate on the ventral surface for reception of the reflected propodus; the propodus is swung more obliquely and the related fingers have a distinct curvature, or bowed aspect when viewed from the outer lateral side, the distal portion of the fingers is bent outward. The upper and outer proximal portion of the palm has the same circumscribed area defined by a linear sulcus as does the opposite cheliped. The proximal portion of the palm above the finger is strongly and a little obliquely truncated for the support of the opened finger; there is a circular spot defined on this distal area. The lower finger is short, thick, the cutting edge curved externally, is sinuate with a strong rounded molar and beyond this obscurely a second less pronounced tooth, the tip of the finger is very acuminate, overlapping on the outer side the similar acute apex of the upper finger. The upper finger has a sinuate cutting edge interfitting with that of the lower

finger and tip overlapping on the inner side of that of the lower finger. The proximal area on the base of the upper finger is dorsally flattened, and with a distinctive circular spot that fits against an opposed circular area on the distal margin of the palm, when the finger is wide open. The lateral surfaces of both fingers are beset with numerous long bristles, the surfaces of the palms being more sparsely setose.

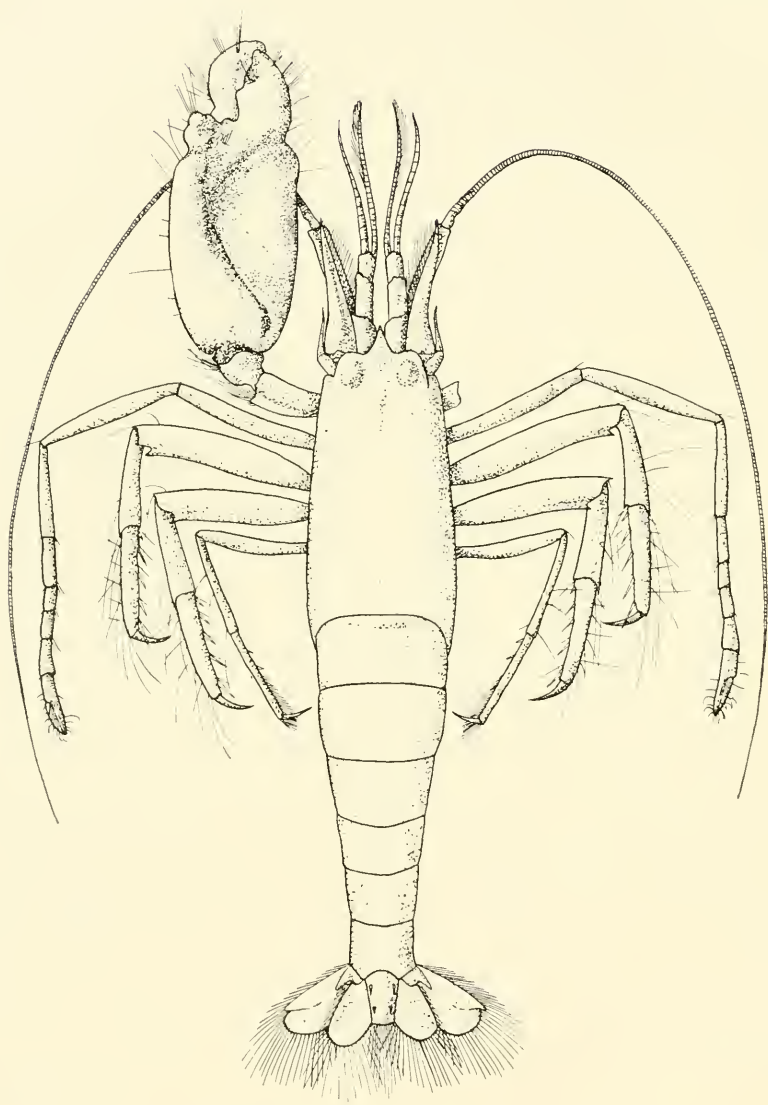
The second right leg measures: ischium, 2 mm. long; merus, 4 mm. long; carpus: first joint, 2 mm.; second joint, 1 mm.; third joint, 0.6 mm.; fourth joint, 0.7 mm.; fifth joint, 1.5 mm. long; propodus, 1.4 mm., the palm being 0.75 mm. and finger 0.65 mm. long. The upper and lower lateral margins of both fingers are bristling with long setae and there are a few short setae on the cutting edges of both fingers.

The second left leg, on the same side as the largest first cheliped, measures: ischium, 2 mm. long; merus, 4 mm. long; carpus, first joint, 2 mm. long; second joint, 1 mm.; third joint, 1 mm.; fourth joint, 1 mm.; fifth joint, 1.45 mm. long; propodus, 1.5 mm., the palm being 0.75 mm. and the finger 0.65 mm. long, with the distal and lateral margins of these fingers carrying a much heavier brush of setae than occur on the opposite second hand.

The third leg has the ischium short, obliquely produced distally, supporting the merus; the merus is 1.8 mm. wide in the median region and 5 mm. long; the carpus is slenderer, laterally compressed, 2.5 mm. long; the propodus is 3 mm. long, more compressed laterally, 1 mm. median width, armed on the inferior lateral margin with a series of six strong, articulated spines subequally spaced, plus a seventh similar spine beside the distal sixth spine; the dactyl is 1.5 mm. long, stout, with blunted, weakly bifid tip caused by the termination of the longitudinal sulcus of the outer lateral face; the ventral-lateral surface is slightly swollen and has the external surface microscopically corrugated.

The fourth pair of legs is similar to the third pair, but is shorter and extend only to about midway the propodal joint of the preceding pair.

The fifth pair of legs is quite slender and extend only to the base of the propodus of the third pair. The dactyli of the fourth and fifth pairs of legs are less conspicuously bifid at the tips, but the ventral-lateral surface is similarly channelled.



Alpheus braschi, new species, type $\times 8$.

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Alpheus braschi new species

Plate 34

TYPE: One small, ovigerous female, taken at Pago Pago, Samoa, September 2, 1931.

DISTRIBUTION: Restricted to the type.

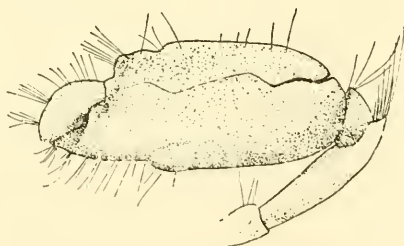
TECHNICAL DESCRIPTION: Rostrum acuminate, strongly carinate, anteriorly projecting as far forward as does the first antennular article; the sides of rostrum slope decidedly downward from the median carina; width at the base of rostrum between the orbits equal to about two-fifths of the anterior rostral process; the rostrum is separated from the ovoidal orbits by an incurved channel, which is narrow and continues backward to the base of the orbit posteriorly. The rostral carina is continued posteriorly for three-fifths of the length of the carapace, vanishing by diminishing height.

The antennulae have the peduncle four-fifths as long as the antennal peduncle and scaphocerite. The first antennular article extends as far as does the rostrum; the second article is longer than the dorsally visible portion of the first article and is twice as long as the third article; the flagellum has the smaller, outer

branch one and one-half times as long as the peduncle, quite thick for the proximal three-fourths of the length, the distal fourth being thread-like; the longer branch is two and one-half times as long as the shorter one and very fine.

The antennae have the basal article strong, supporting a slender stylet-like stylocerite that extends 45 per centum of the scaphocerite; the scaphocerite is as long, but nowhere so wide as the cylindrical carpocerite with which it is subequal in length. The scaphocerite is principally a strong stylus, with the outer lateral margin concavely excavate; the tip very acuminate, the outer side of the scaphocerite is much thickened; the inner side is greatly reduced, scarcely three-fifths as long as the outer portion, less wide proximally than the outer thickened half, tapering distally, sloping narrowly to the margin of the thickened outer half; this inner side is fringed along the distal half of the outer margin with very long, web-like setae, projecting distally a little beyond the apical spine; these web-like setae, unless most critically examined, give the illusion of being the oval inner half of the blade usually present in *Apheids*, but which is conspicuously absent in the present species. The flagellum is quite fine, slightly longer than the entire body.

The abdominal terga are moderately compressed, the lateral margins not greatly produced, the twelve eggs being arranged in series of three, one behind the other, between the pleopoda. The telson is 1.2 times as long as the sixth abdominal segment, much tapered, with truncate distal margin, the dorsal margin is armed with two pairs of submedian, articulated spines and has a slight median depression proximally; the distal margin is fringed with long setae. The uropoda have each blade a third longer than the



Text figure 10—*Alpheus braschi* Boone, outer lateral view of great cheliped, $\times 8$.

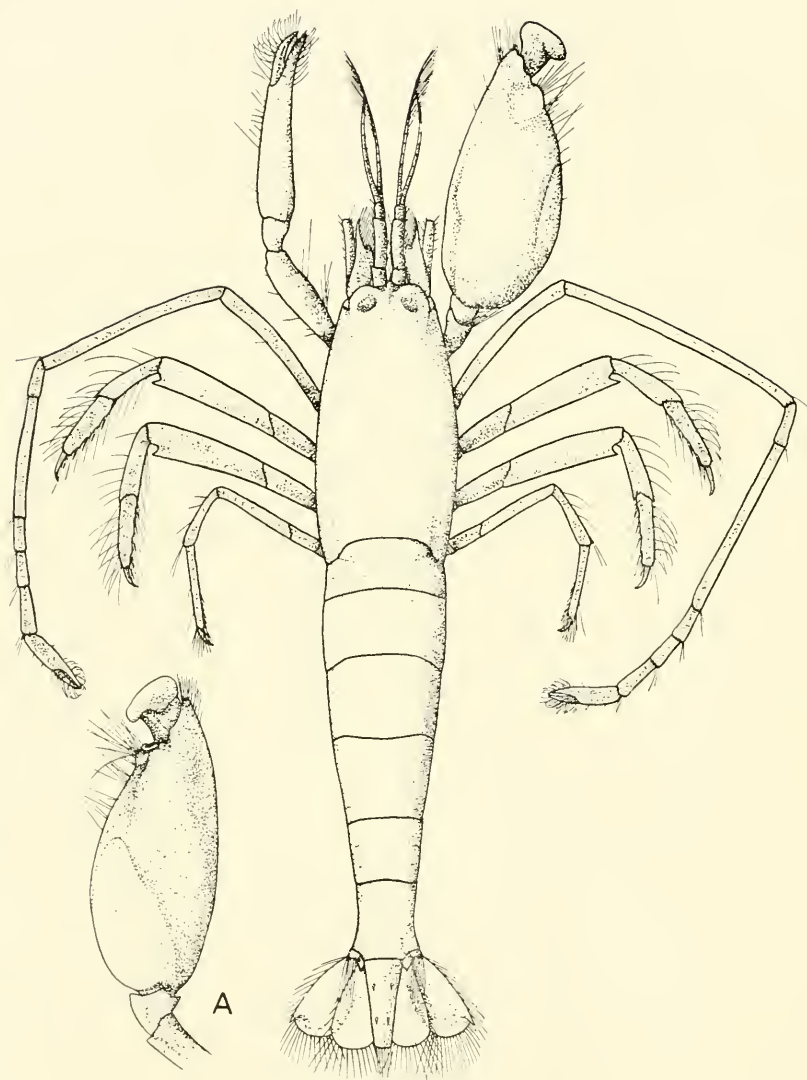
telson; the inner blade is rather widely, evenly ovate, the outer blade is similar, slightly wider, transversely articulated distally, with an acute distal tooth at the termination of the outer lateral margin.

The great cheliped has the ischium small, laminate, one-third as long as the merus; the merus is 2 millimeters long, fragile, much slenderer than either finger, narrowly triquetral, being extremely compressed laterally and having a distinct concave excavation on the dorsal distal margin and an acute subdistal tooth on the inferolateral margin; the carpus is also very small, convex, distally concavely cup-like on the dorsal half; the propodus is very large, as long as the ischium and merus considered together. The palm has proximally on the outer distal and upper outer surfaces a deep incision or groove, that is completely excavate on the proximal end and continued on the upper half of the outer surface sinuate, thrice recurved, becoming shallower distally and vanishing in an upturned curve that becomes contiguous with the very deep transverse channel which occurs across the upper surface, subdistal to the end of the palm above the base of the upper finger and obliquely situated and terminated definitely on the inner upper margin, being closely adjacent to, but separated from, a wide deep groove that distally runs down and forward obliquely to the base of the inner edge of the upper finger; the upper end of this oblique portion of the groove curves immediately below the before mentioned transverse groove and thence curves downward, widening conspicuously about midway the palm, thence curves downward almost to the posterior margin, becoming weaker as it progresses and vanishing on the lower posterior margin at a point where the curved proximal lower margin unites with the nearly straight lower margin; anteriorly, about two-thirds of the length of the palm from the base, the above defined groove is united with another groove, which extends abruptly obliquely down to the base of the lower finger and widens into a deep channel on the lower surface of the finger, extending entirely across the lower surface and up on the outer surface of the palm to a point midway the proximal width of this finger; running back from this transverse inferior channel, on the lower and slightly outer surface, there is a not quite straight linear groove that vanishes almost at the posterior margin. The hinged finger is short, proximally broad on the outer surface, with the upper lateral margin sinuate, and there is a small

rounded lobe opposite the base of the finger, followed by a much broader, node-like one, beyond which the apical portion is abruptly smaller, acuminate, curved inward, overlapped on the outer lateral surface by the blunt terminal of the upper finger. The cutting edge of the lower finger bears proximally a very deep, obliquely excavated roundish cavity, into which the large oblique molar of the upper finger fits, so completely encased that it is nowhere visible when the fingers are closed. The upper finger is dorsally separated from the palm by a V-like space, due to the fact that the proximal dorsal surface of this finger is truncate and bears a circular defined flat space, which, when the fingers are opened, fits upon a similar space on the upper distal margin of the palm. Just above this circular space, on the base of the upper finger, the lateral margins of this truncate portion converge, the upper margin from this point onward being a broad convexity; the apical portion also being a broad, rounded thickened process for a depth equal to a little over half the length of the finger and terminating inwardly in a subacute, denticle-like angle. Inside this broad convex tip, the brief cutting edge is almost entirely occupied by this deep obliquely inward and downward-directed blunt, subcylindrical, distally convex basal molar tooth. On the upper and outer surfaces of both fingers there are several tufts of long, slender bristles that radiate from this point of attachment. These bristles are also present above the base of the upper finger. These tufts are nowhere very numerous and are not concentrated subdistal to the finger tips.

The second leg is characteristically slender and measures as follows: ischium, 1.1 mm. long; merus, 2 mm. long and 0.5 mm. greatest width, armed with an acute spine at the subdistal, inferior lateral angle; carpus, first joint, 1.5 mm.; second joint, 1.0 mm.; third joint, also 1.0 mm.; fourth joint, 1.3 mm. long; fifth joint, 1.1 mm. long; propodus, palm 0.8 mm. and the finger 0.7 mm. long. The cheliped is so compressed laterally that it is laminate; the fingers are pointed, setose.

The first and second pairs of ambulatory legs are similar, almost subequal in length and also in the breadth of the meral joints, but the third pair of legs, at least in the present specimen, is conspicuously more fragile. The first ambulatory leg has: the ischium, 0.7 mm. long; the merus, 2.2 mm. long and 1 mm. greatest median width; the carpus, 0.9 mm. long, slenderer; the propodus,



Alpheus obesomanus Dana, $\times 9$.
A, outer lateral view of same great cheliped.

1.65 mm. long, 0.5 mm. wide proximally, very slightly tapered, armed on the inferior lateral margin with about seven longish, acute, articulated spines which are interspersed with long, solitary setae; the dactyl is 0.9 mm. long, tapered, laminate, acuminate, unguiculate, with no accessory spines. The second leg is identical and the third leg measures in the same proportions, but appears different simply because it is so thin and small. Epipodites are present on the legs, although rather small on the third pair.

REMARKS: While very close to *Alpheus parvirostris* Dana, with which Dr. Coutiere, after examination of the type *A. lineifer* E. J. Miers, has placed the latter as a synonym, this being confirmed by the researches of Dr. de Man ("Siboga" report), the present Samoan species is unquestionably distinct therefrom, as evidenced by the distinctive channelling of *both surfaces* of the great cheliped of the type, an adult female. As neither Dana, whose type is reported by de Man to be an adult female, Miers, Ortmann, Coutiere, de Man nor Lanchester describe the distinctive channelling possessed by the present species on the outer surface and make no mention whatever of any channelling on the inner surface of *A. parvirostris*, the latter evidently does not exist.

NAME: This species is dedicated to Mr. F. E. Brasch, curator of the Smithsonian Division, Library of Congress, in appreciation of the many courtesies he has extended the writer during the preparation of this report.

Crinitus Group, ss. Coutiere

Alpheus obesomanus Dana

Plate 35

TYPE: Dana's type came from the Fiji Archipelago and is deposited in the Philadelphia Academy of Natural Sciences.

DISTRIBUTION: Gulf of California (Coutiere); Sandwich Islands (Randall); Honolulu (Bate); Palmyra Island (Edmondson); Sandwich Islands and Fiji Islands (Dana); Tahiti (Heller); Society Islands (Boone); Nicobar Islands (Heller); Samoa (Lenz); Sydney, New South Wales (Heller); Tamatave, Madagascar (Lenz); Lifu, Loyalty Islands, Blanche Bay, New Britain (Borradaile); Trincomalee, Ceylon (Muller); Bombay (Guerin); Gulf of Aykab and through the Red Sea (de Man).

MATERIAL EXAMINED: Six specimens, one ovigerous, in coral, Teviatea Reef, Raiatea Island, Society Islands, August 21, 1931. One ovigerous female, and one male, Venus Point Reef, Tahiti, August 15, 1931. One large specimen, in coral, Temukus Roads, Bali, Dutch East Indies, October 25, 1931. All collected by the "Alva."

TECHNICAL DESCRIPTION: Rostrum short, acuminate, dorsally carinate, from the apex, which is scarcely protruberant beyond the frontal margin, to a point slightly posterior to the orbit; orbits large, convex, without an apical spine, composed of large, black hemispherical facets. Carapace rather widely rounded dorsally, laterally compressed, with the anterolateral margin closely appressed, rounded. Carapace length, including rostrum, 5 mm.; rostrum, 0.5 mm. long; height of carapace in median area, 3 mm.

The antennular peduncle has the visible portion of the first article about one-half of the length of the second article; the second article is about twice as long as the third article; the flagellum is two-branched, the upper, shorter branch is three-fifths as long as the lower, and thicker, with a distal brush of setae; the outer branch is one-half as long as the antennal flagellum. The stylocerite is quite small with a fine denticle-like tip that does not extend beyond the margin of the related segment.

The antennal scaphocerite is very short, with the distal outer portion slightly but definitely outcurved, very acuminate; this acuminate outer portion narrowed, equal to two-fifths of the entire length of scaphocerite, its apex almost reaching the distal margin of the third peduncular article of the antennulae; the inner portion of scaphocerite is only three-fifths as long as the outer and separated from the latter distally by a small incision; the inner portion is distally very narrow, rounded, widening slightly proximally. The second and third peduncular articles are slender, cylindrical, and are as long as the antennular peduncle. The antennal flagellum is fine and quite long, about twice the length of the longer antennular whip.

The abdominal terga are rather broadly rounded in the females, less so in the males; the female brood pouch is very capacious. The telson is longish, one and two-thirds times as long as the preceding segment, distally triangulate, with the apex bluntly rounded, narrowed, setose; the dorsal surface is smooth, with a median longitudinal wide sulcus and with three pairs of articu-

lated spinules set in longitudinal series, one of each pair on either side of the median sulcus, the proximal pair of spinules being about one-third of the telson length from base, the second pair midway between the first and third pairs, which latter are on the distal telsonic margin. The uropoda are about as long as the telson, the outer blade the larger, widely rounded distally, and rather truncated, the outer lateral margin thickened and terminating in an acute tooth; the inner blade is narrower, more convex distally; both blades are ciliate marginally.

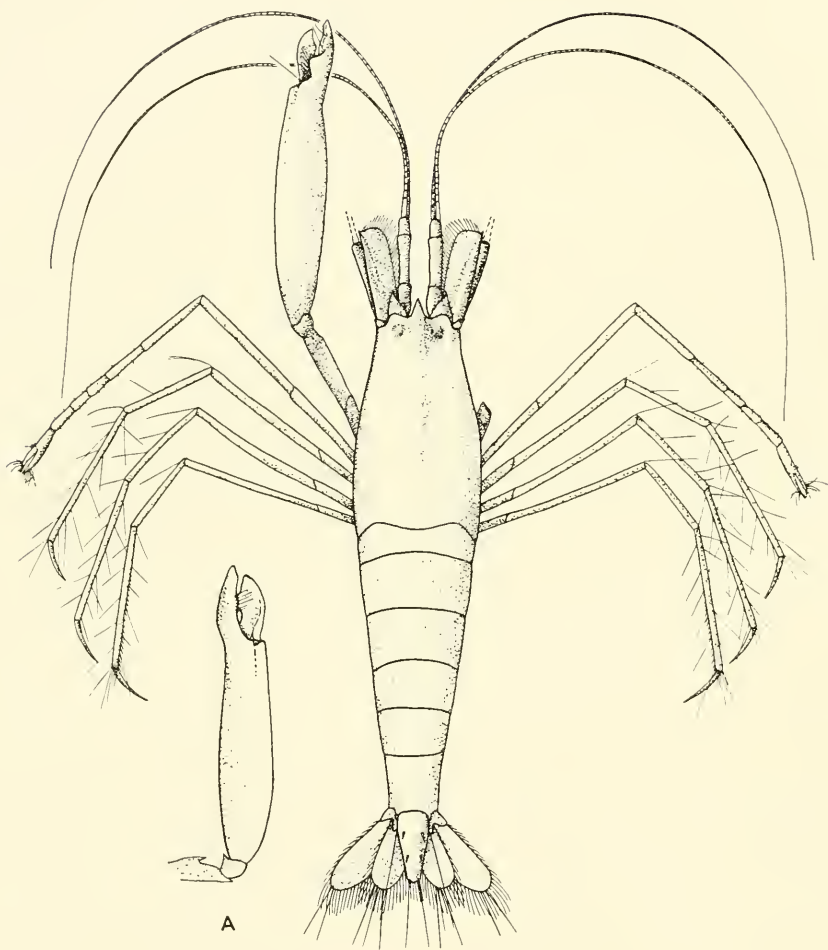
The great cheliped (female) is about as long as the related carapace and has the extraordinary shape figured; the ischium, merus and carpus quite slender, successively longer; the carpus slender, small, cup-like, with the upper distal margin distinctly excavate for the reception of the protruding convex distal end of the palm; the lower distal carpal margin is also laminate-excavate; the palm is about as long as the related carapace and is much thicker and higher proximally than distally, the proximal half being distinctly dilated, convex, with the upper proximal end rounded, protruberant, and with a circumscribed large irregularly elliptical area on the upper and outer proximal surface; this area narrower distally and extending about one-half the length of the palm. Beyond this, near the dorsal of the outer surface of the palm, there is a short oblique, irregular, nearly longitudinal depression, which coalesces with a transverse depression that in turn unites with an oblique depression on the inner surface of the palm and this defines a distinct, dorsal, rounded hump, which is followed by a deep, irregular pit, into which the closed finger end fits and which is succeeded by the double-lobed dorsal margin of finger, which margin is thickened, and on the outer side is sinuous, defining a small denticle; this is succeeded by a convex lobe, which in turn is defined from the distal concave margin. On the inner surface this distal margin is separated from a large, rounded lobe, which is distinct from a small denticle, nearly opposite the base of the upper finger, and which is succeeded proximally by another larger node or lobe. Just above this node, on the distal border of the palm, is a rounded circular area which interfits with a similar flat, circular area on the proximal side of the finger below the enlarged distal node. The finger is a T-shaped mallet with the cross-bar much thickened and convex at both ends; on the distal side of the supporting center bar of the T, near its base, there is

a large rounded molar which on occasion fits into a deep concavity in the upper surface of the propodal finger. On some specimens (female) this molar is not present. There are distinct long setae present on either side of the dorsal depression of the palm into which the finger closes, also many more setae present in tufts of fringe-like formation across the distal margin of the propodal finger; some setae are present along the ventral margin of this finger.

The small cheliped is four-fifths as long as the great one but much weaker; the merus is elongate, laterally much compressed for the proximal three-fifths, the distal two-fifths moderately dilated, yet compressed; the carpus relatively longer than in the great chela, dorsally rounded, distally concave; the propodus with the palm curiously four-sided, two and a half times as long as the carpus; the propodal finger about one-half as long as the palm, tapered, cutting edge concave, tip meeting upon that of the similar upper finger.

The second right leg, adjacent to the great cheliped, has the basis short, the ischium very slender, greatly elongated, 3 mm. long; the merus similar, 5 mm. long; the carpus, with the first joint, 1 mm. long; the second joint, 3 mm. long; the third joint, 0.5 mm. long; fourth joint, 0.5 mm. long; fifth joint, 1 mm. long, subequal to the palm of propodus, which is much compressed laterally, somewhat rectangular, 3 mm. high; the propodal finger tapered, 4 mm. long; the upper finger more curved, also 4 mm. long; both with the tips hollowed, meeting; the adjacent region fringed with long setae; fingers separated by a narrow elliptical sinus. When fully extended, it reaches beyond the great chela. The second left leg (female) has the basis short; ischium, 2 mm. long; merus, 3 mm. long; carpus, first joint, 0.75 mm. long; second joint, 2 mm. long; third joint, 0.7 mm. long; fourth joint, 0.7 mm. long; fifth joint, 0.9 mm. long; propodus, palm, 1 mm. long; finger, 0.7 long; upper finger, 0.7 mm. long, separated by an elliptical gape, tips scooped, meeting; margins bristling with setae.

The third leg is very slender and rather long when extended, reaching slightly beyond midway the palm of the great cheliped; the merus is much compressed laterally, quite elongated, 1 mm. greatest width, 3 mm. long, with each distal angle an acute tooth; carpus narrower and shorter, 1.7 mm. long, with an acute distal spine on the inferior margin; propodus still slenderer, 1.7 mm.



Alpheus explorator Boone, type $\times 3$.

A, great cheliped shown from the outer lateral surface.

long, subequal in length, armed with three to four acute, subequal spines on the inferior lateral margin; dactyl short, 0.4 mm. long, tip curved, inferior lateral margin sulcate, tip unispinose, acuminate; upper lateral margin of meral, carpal, and propodal joints beset with numerous long, solitary setae.

The fourth pair of legs are similar to the third pair but when fully extended reach only about midway the propodus of the third pair of legs.

The fifth pair of legs are of approximately the same relative length to the fourth pair, as these bear to the third pair of legs but are definitely slenderer; the propodus devoid of spines on the inferior lateral margin and possessing a distinctive distal fan-like "cuff" of setae which, on the inferior side, surround the dactyl and are about twice as long.

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Crangon obesomanus, EDMONDSON, C. H., Bull. B. P. Bishop Mus., vol. V, 1923, p. 28.

Alpheus explorator, new species

Plate 36

TYPE: The type was dredged in 140 fathoms, in Flores Strait, near Larantuka Village, Flores Island, Dutch East Indies, October 22, 1931, by the "Alva."

DISTRIBUTION: A deep sea species of *Alpheus* thus far restricted to the type.

TECHNICAL DESCRIPTION: Rostrum triangulate, extending about 1 millimeter beyond the carapace margin, dorsally carinate, this carina extending posteriorly upon the carapace a little more than half-way back, or to the obsolete cervical suture. Fronto-

orbital margin very shallowly rounded, each orbit about twice the diameter transversely of the base of rostrum; a slight sulcus separates the orbit from the rostrum.

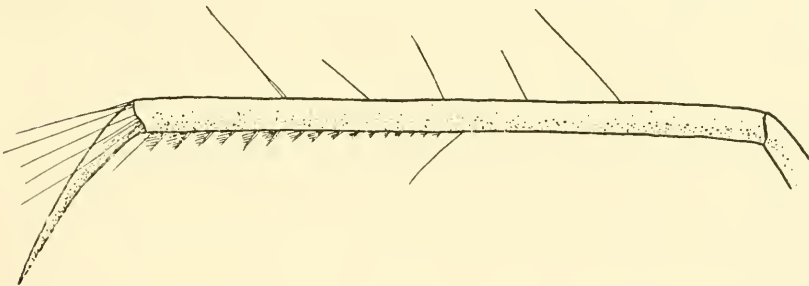
The antennulae have the peduncle with the first article two-thirds as long as the second article, which is twice as long as the third article; the total peduncle exceeding the length of the antennal peduncle by four-fifths of the distal joint of the antennulae. Scaphocerite with the outer margin slightly bowed, a small subdistal tooth; the distal margin evenly rounded, fairly broad, ciliated; the inner lateral margin is convex; the scaphocerite distinctly widening proximally. The antennal flagellum is broken off. The antennular flagellum has the inner branch a little longer than the entire body, or about 45 per centum longer than the outer branch; the proximal third of the outer branch is about twice as thick as the distal two-thirds, which is very fine, as is also the entire inner branch.

Carapace and body moderately slender, laterally compressed. Sixth abdominal segment only one-fourth longer than the fifth segment and five-sixths as long as the telson, which is dorsally rounded, armed with two pairs of articulated spines and a third pair of spines at the distal margin; lateral margins convergent distally, distal margin truncate, narrowed, ciliate, not extending quite so far as does the inner blade of the uropoda. Uropoda with both blades widely oval distally, the outer one the wider and with an external subdistal tooth.

Left great cheliped (the right is missing) with the merus arched, exceedingly slender, with an acute subdistal tooth on the inferior lateral margin; carpus short, cup-like, with the distal upper margin tri- or quadri-dentate; propodus normally laying in a horizontal position so that the true dorsal margin and upper finger are on the outside and the normally ventral margin and fixed finger is on the inner lateral margin. The propodus is as long as the carapace and the first and second abdominal segments; and has the upper (outer) lateral margin of the palm subcarinate and terminating distally in a blunt angulation, the anterior face of which is flat and is opposed to a similar flat area on the proximal upper surface of the movable finger. The fixed finger is bent inward at a decided angle at its base and is one-half times as long as the palm, also one-quarter longer than the upper finger. The lower finger is produced on its upper side, about midway its length,

into a conspicuous right-angled tooth, inside of which the upper surface of the lower finger is deeply excavate for the reception of the oblique, long tooth of the upper finger; beyond this cavity the upper surface of the lower finger is highly channelled medially, the lateral margins are convergent to an acuminate tip, this distal portion extending substantially beyond the tip of the other finger. The latter is short, laterally compressed, very convex dorsally with the proximal portion narrowed, the distal portion a broad, thickened blunted blade, from the proximal inner angle of which there arises a rounded node-like tooth, directed obliquely backward. The inner lateral cutting edge of the lower finger is trisinate.

The second pair of legs are very thin, subequal, when extended, reaching almost to the base of the fixed finger of the great cheliped. The ischium is 3 mm. long; the merus is 3 mm. long; the carpus is 3.2 mm. long; the first joint is 1.5 mm. long, the second joint is 0.5 mm. long, the third joint is 0.45 mm. long, and the fourth joint is 0.75 mm. long; the propodus has a total length of 1.5 mm., the palm being one-half of this.



Text figure 11—*Alpheus explorer* Boone, type: distal joints of third leg, showing the articulated spines on the inferior lateral margin of the propodus, greatly enlarged.

The first, second and third pairs of ambulatory legs are similar, successively slightly shorter, all exceedingly slender; the ischium of the first pair is 1 mm. long or two-fifths as long as merus, which is 2.5 mm.; the carpus is 1.5 mm. long; the propodus is 3 mm. long, distally cuffed on upper margin with bristles, spread fan-like; the dactyl is 1.6 mm. long, curved, dorsoventrally laminate, with the lateral margins tapered to an acuminate tip.

The external maxillipeds are pediform, slender, with the distal article bearing black-tipped spines and extending almost to the tip of the antennal peduncle.

DISCUSSION: The present species, which is closely related to *A. macroskeles* Alcock and Anderson, and also to *A. talismani* Coutiere, differs from *macroskeles* as figured by Coutiere, in that the present species has the antennular peduncle longer by the third article than the inner portion of the scaphocerite, while *macroskeles* has these two subequal in length. The stylocerite of *explorator* is distinctly shorter in ratio to the related first antennular joint and is also broader, or wider, with the lateral margins more convex than in *macroskeles*; the apical spine of *explorator* is acute, but is more decisively set apart from the convex proximal portion of the stylocerite than is that of either *talismani* or *macroskeles*. The rostrum of the present species has about the same length ratio to the first antennular peduncle joint as in the two other species, but is distinctive in that it continues posteriorly as a distinct carina for a little more than half the length of the carapace. The great cheliped resembles that of *talismani* in its much attenuated slenderness, but differs in having the fixed finger of *explorator* bent inward at a decided angle, in having this finger a little longer in ratio to the palm and in having the upper finger shorter in relation to the fixed finger.

Dr. Alcock stated of *macroskeles* that "the eyes are markedly deficient in pigment"; but *explorator* has fairly large, well-developed ocular areas visible dorsally as circular spots and also visible slightly as black ocular lobes protruding on the frontal region slightly beyond the carapace.

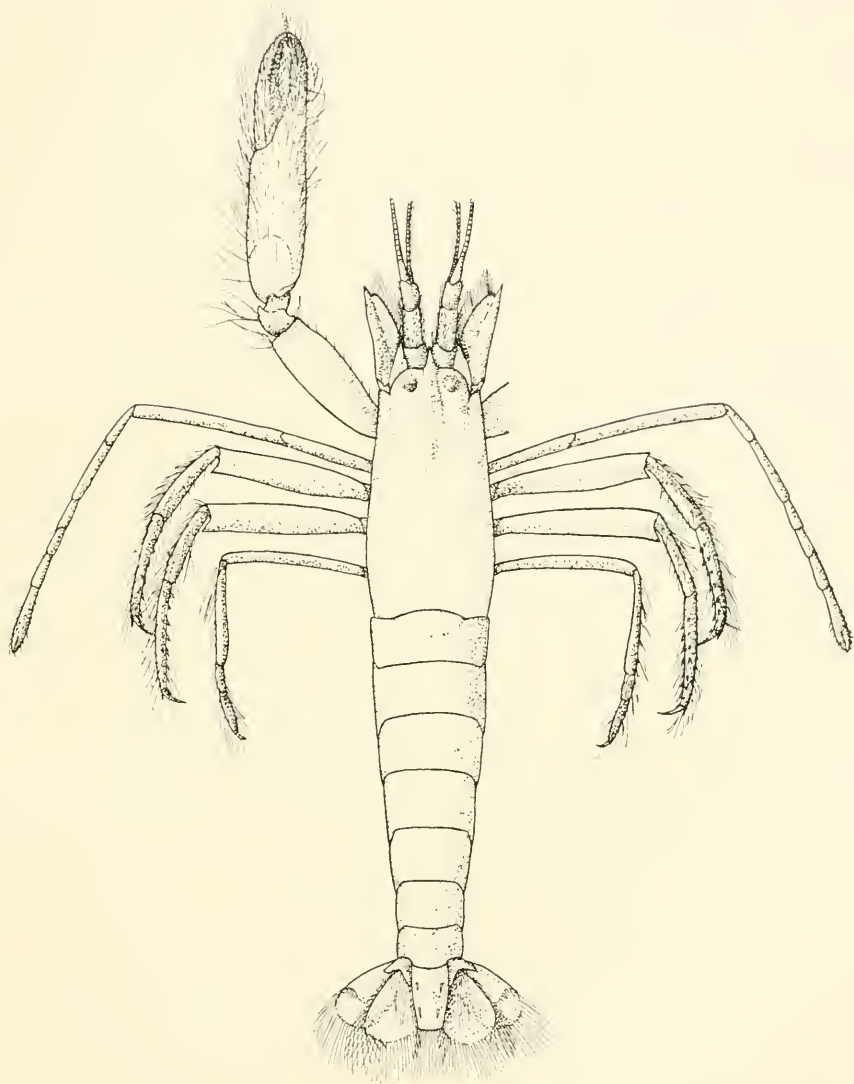
Brevirostris Group, ss. Coutiere

Alpheus rapax Fabricius

Plate 37

TYPE: Fabricius' type came from the East Indies and, if still extant, is very probably in the British Museum.

DISTRIBUTION: Red Sea, Djibouti (Coutiere); Massaouah (Nobili); King Island, Mergui Archipelago (de Man); Hulule, Malé Atoll, Maldives (Coutiere); Sagami Bay, Japan (Doflein); Zanzibar (Hilgendorf).



Alpheus rapax Fabricius, $\times 3$.

MATERIAL EXAMINED: Three specimens, collected in coral, Falcon Island, Palm Islands, Queensland, October 7, 1931, by the "Alva."

TECHNICAL DESCRIPTION: Rostrum dorsally carinate, arising slightly posterior to the orbital lobe and projecting two-sevenths of its length beyond the carapace, the acuminate apex extending as far forward as the distal margin of the first peduncular article of the antennulae. The orbital lobes are separated from the rostrum on each side by a deep, wide sulcus that extends as far back as the lobes, which are large, convex, devoid of a spinule but with a minute angulation of the frontal margin when viewed in profile; the black corneal area is large, spherical.

The carapace is moderately compressed laterally, evenly rounded dorsally; length, 13 mm., including the rostrum; rostral projection beyond the carapace, 1 mm. long; entire rostrum, 3 mm. long.

The abdominal terga are smooth, evenly rounded; the telson is almost one-fourth longer than the preceding segment; the distal margin truncate, evenly rounded, setose; the dorsal surface evenly rounded, smooth, armed with two pairs of submedian, articulated spinules in longitudinal series; the proximal pair being not quite half-way the telsonic length from the basal margin; the second pair being situated half-way between this and the distal margin. The peduncle of the uropoda is distally bilobate, produced to an acuminate lobe about the base of the inner blade and an even more acuminate, spinose lobe above the outer branch. Both blades are quite broad distally, the outer blade being a little the wider and more convex distally, with a small, subdistal denticle on the outer lateral margin and a strong transverse suture extending inward from this point; the inner blade is rather truncated distally and shallowly rounded; both are subequal in length to the telson and fringed with web-like setae.

The antennulae have the stylocerite lobate, acuminate, rather wide proximally, with the outer margin convex, the inner margin convex proximally, slightly concave distally, the apex acute, extending as far as the distal margin of the first peduncular segment, as does also the rostrum. The second antennular article is one and two-thirds as long as the first; the third article one-half as long as the second; all three joints are much beset with long setae on the upper surface; the flagellum has the short branch

two-thirds as long as the carapace and thick-ringed for the proximal half of its length; the longer branch is very fine, one and one-half times as long as the carapace.

The antennae have the peduncle subequal in length to that of the antennulae and support a scaphocerite which is subequal in length to the two peduncles, the scaphocerite having its outer margin thickened, the outer lateral contour moderately concave; apex acuminate, projecting beyond the rounded, narrow, inner portion and dorsally defined from it by a flat carina; the inner portion widens proximally and is fringed with setae along its entire margin; the antennal flagellum is very fine and quite long, being one and one-third times the body length.

The external maxillipeds are pediform, extending not quite as far as the antennal peduncle, but heavily fringed with long stiff bristles that do project substantially beyond this point.

The great cheliped is missing from all three specimens. (Consult Dr. de Man, "Siboga," for figure and description.

The lesser cheliped of the male is, according to Dr. de Man's excellent description, nearly as long as the great cheliped, but not so large otherwise. The small cheliped of the present specimen has the merus trigonal, with all three lateral margins carinate, the inner inferior lateral margin spinose-granulose, the inner lateral surface closely appressed to the carapace; the inferior face wider distally and concave; the outer lateral face irregular; the carpus is short, rounded, with the upper surface distally laminate-excavate; the propodus has the palm slightly longer than the merus and the fingers four-fifths as long as the palm; the palm is one-half as high as long, with the inner and outer faces moderately convex, a circumscribed elliptical-oval area on the proximal inner and upper faces; running forward from this on the inner face a short longitudinal sulcus, vague, but reaching half-way to the base of the finger. There is a distinct transverse shallowness or termination of the upper margin of the palm at the base of the upper finger and on the outer lateral surface of the palm a small spine occurs at the base of the lateral border of the dorsum of the finger. A similar less acuminate denticle occurs on the inner lateral margin approximately with the same location. The propodal finger is five-sixths as long as the palm, somewhat oblique, with its cutting edge a deep concave trough, the outer lateral margin carinate, the inner lateral margin but little less so; some-

times there is a spinose dentition on the proximal portion; the apex is an acuminate, upcurved spine. The upper finger is similar and subequal; the fingers, when closed, meeting throughout their entire length along the carinate outer lateral margin, the tips overlapping but with a distinct elliptical trough separating them, when viewed from the inner lateral surface. Numerous tufts of long setae occur on the lower, inner and upper surfaces of the palm and on all outer surfaces of the fingers, being especially abundant along the lateral margins of the cutting edge and at the tips of the fingers.

The second left leg, adjacent to the small cheliped, is very slender; the ischium, 5.5 mm. long; the merus, 5.8 mm. long; the carpus: first joint, 3.0 mm. long; second joint, 2.5 mm. long; third joint, 1 mm. long; fourth joint, 1 mm. long; fifth joint, 1.8 mm. long; propodus: palm, 1 mm. long; fingers, 1 mm. long, subequal, meeting throughout their length, tips fringed with bristles. The second right leg is similar.

The first ambulatory leg has the ischium two-fifths as long as the merus; the merus is half as long as the carapace; the carpus is three-fifths as long as the merus, clavate, widening distally; the propodus is one-third longer than the carpus, much more compressed laterally, thickish, as wide as long, armed on the inferior lateral margin with a double longitudinal series of six pairs of articulate, acuminate spines; the dactyl is two-fifths as long as the propodus, curved, thickish, with strong, pointed tip. The fourth and fifth pairs of legs are similar to the third pair, but are successively shorter; the fifth pair is also definitely thinner.

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Alpheus, new species

MATERIAL EXAMINED: One specimen with the great claw missing, of an apparently new species, taken in coral at Temukus Roads, Bali, Dutch East Indies, October 25, 1931.

TECHNICAL DESCRIPTION: Rostrum acute, carinate apex extending as far forward as the base of the second antennular article and posteriorly carinate for about two-thirds of the carapace, the carina being distinct for the entire distance; anteriorly it is separated on either side from the orbital lobes by a deep sulcus that extends back as far as does the lobe. The orbital lobes are large, rounded, each with a supracorneal spine, well developed, acuminate, projecting beyond the frontal margin for a distance equal to two-fifths of the projected portion of the rostrum. The abdominal terga are widely rounded dorsally with deep laminae, forming a capacious brood pouch. The telson is one and one-third times as long as the preceding segment and about one and three-fifths times as long as the proximal telsonic width, with the sides moderately tapered, the distal margin bluntly truncate, armed with two pairs of median lateral spines on the distal half of the telson and on the distal margin; this margin also has a fringe of long close-set spinules. The uropoda are longer than the telson, the slender ovate inner blade being one-fourth longer and the wider, articulated outer blade being one-third longer. The latter has a coarse black spine at the outer subdistal angle, a trisinate articulation extends inward obliquely from this point and has on its proximal border on the outer half three to seven small spinules, the articulation of this blade has its distal margin convex; both blades are fringed with long setae similar to those of the telson.

The antennulae have the first article 0.75 mm. long, reaching as far forward as does the rostrum; the second article is 1 mm. long; the third article is 0.5 mm. long; the flagellum is two-branched, the thicker branch extending to the base of the fingers; this branch is proximally thick and has multiplumose setae on the lower surface of the thicker portion; the longer inner branch

of the flagellum is quite fine and reaches to the tip of the fingers of the smaller great cheliped. The peduncle is as long as the tip of the rounded or inner convex distal margin of the scaphocerite. The carpopocerite is conspicuous, consisting of a lobate proximal portion of about three-fifths with convex margins, tapering distally two-fifths to a very acuminate point which extends to half-way, or beyond, of the second articles of the antennulae.

The antennae have the basal article strong, the scaphocerite shortish, with the inner convex portion no longer than the antennular peduncle, the outer lateral portion somewhat thicker than the inner, this flat carina tapering to an acuminate point or spine slightly outward curved and extending quite a millimeter beyond the inner portion and not very wide at any point; the margins are fringed with long web-like setae; the second and third peduncular articles are cylindrical, together extending to the distal margin of the scaphocerite; the flagellum is simple, fine, extending for 5 to 10 millimeters beyond the longer inner branch of the antennulae.

The great cheliped is most unfortunately missing.

The smaller first cheliped has the merus slender, elongate, triquetral, armed with an acute tooth at both the upper and lower inner and distal outer angles and a rounded protuberance at the outer distal angle. The carpus is short, cup-like, distally concave for reception of the propodus and with a sinuous indentation of this margin; the propodus, including the fingers, is 7 mm. long, the palm being 3 mm. long and the fingers 4 mm. long, with the upper proximal area of the palm channelled by a sulcus that defines an obconic area; the palm terminates distally in a tooth on either side of the base of the upper finger, the tooth on the inner side of the palm being more acute than that at the outer angle, which is rounded; the fingers are slender, the lower one deeply channelled throughout its entire length, the apex a small upcurved tooth. The upper finger is produced along its inner lateral margin into a definite carina but closes immediately inside the edge of the inner lateral margin of the lower finger, and beyond this carina the upper finger is concavely excavate, thus exposing the inner channel of the lower finger and giving these two fingers, when closed, the aspect of a concave, elliptical sulcus between them when examined from the outer side. There are a few solitary long setae on the upper and outer margins of both the palm and

fingers; toward the tip of the finger these setae become clusters and immediately below each tip is a fan-like cluster composed of more numerous, closer-set bristles.

The second pair of legs is slender. The merus is 2.5 mm. long; the carpus has the first joint 2 mm. long, the second joint 1.2 mm. long, the third joint 0.9 mm. long, the fourth joint 0.7 mm. long, the fifth joint 1.3 mm. long; the propodus is 1.5 mm. long, the palm being about half of this total; the fingers are slender, curved, separated by an oval ellipse, the tips meeting; there are clusters of outstanding bristles on both sides of the upper finger subdistally.

The ambulatory legs are very slender, similar, decreasing in length in the order 1, 2, 3. The right leg of the first pair measures: ischium, 1 mm. long; merus, 3.5 mm. long, and 0.7 mm. median width, not much expanded at this point; the carpus is 1.8 mm. long; the propodus is 2.5 mm. long, and is 0.5 mm. wide, not tapered throughout the length, armed with ten to twelve articulate spines along the inferior lateral margin; the dactyl is one-third as long as the propodus, scimitar-like, very tapered, curved, acuminate, and has no accessory spines.

The external maxillipeds are pediform, extending as far forward as does the antennal peduncle and have the distal articles multiarticulate, rather fleshy, and tipped distally with a brush of bristly setae.

Alpheus, new species

MATERIAL EXAMINED: An imperfect specimen of an apparently new species, taken in coral, Temukus Roads, Bali, Dutch East Indies, October 25, 1931.

TECHNICAL DESCRIPTION: Rostrum very conspicuous, long, directed upward, with three-fifths of the apex projected beyond the carapace, reaching the distal margin of the third peduncular article of the antennulae, narrowly triangulate, with the width at base not quite one-half of the total length, devoid of dorsal carina and not separated from the orbits by sulci; the ventral surface of the rostrum is produced into a conspicuous laminate carina, the ventral margin of which is convex, tapering in both directions. The orbits are not convex dorsally and their respective frontal margins are but little rounded; the pigmentation areas are separated from each other by a distance equal to the width of one eyespot and are also set well back from the frontal margin; they are

not quite subcircular, being more elliptical and wider transversely. The carapace is smooth, microscopically regularly setose.

The stylocerite is slender, acuminate, with the sides not at all convex, the apex reaching four-fifths of the length of the peduncular article of the antennulae. The antennulae are short with the dorsally visible portion of the first article about four-fifths as long as the second article; the second and third articles are subequal, nearly as wide as long; the inner branch of the flagellum is slender, about one and one-half times as long as the carapace; the outer branch (which is broken) has the proximal portion characteristically thickened for a distance equal to three-fourths of the peduncle and beset with close, short setae.

The antennae have the basicerite rather heavy, with a spine at the inferior outer distal angle; the carpocerite is cylindrical, about three and one-half times as long as wide, reaching almost to the distal margin of the second article of the antennular peduncle, or not quite so long, by about 1 millimeter as the inner portion of the scaphocerite; the scaphocerite is very short, reaching only half-way the distal peduncular article of the antennae and has the inner distal portion widely rounded, the outer distal margin terminating in a sharp tooth; the inner distal and lateral margins fringed with long cilia; the width of the scaphocerite is three-fourths of the length.

The abdominal segments are very compressed laterally; the epimera are rather regularly truncate on the lateral margins, the body having a very compact, slender, subcylindrical appearance, neatly tapered posteriorly; the sixth segment is one and one-half times as long as the fifth segment, or two-thirds as long as the telson, which is rounded dorsally, armed with two pairs of articulated spines; the first pair of these are placed about mid-way the telsonic length; the second pair are about half-way between the first pair and the distal margin; the distal margin is about half as wide as the proximal border, abruptly, squarely truncate, armed with a pair of acuminate spines, one at each angle, each spine triangulate, two-thirds as long as the distal border of the telson, which is heavily setose. The telson is almost as long as the inner blade of the uropoda, and nearly as wide distally.

The large great cheliped is regrettably missing. The small first cheliped is compact, short, reaching not quite so far as the distal margin of the scaphocerite and only a trifle longer than the

external maxillipeds. This leg has the ischium 0.5 mm. long; the merus triquetral, arched, 2.8 mm. long; the carpus 0.8 mm. long; the propodus has a total length of 2 mm., of which the palm is 1.1 mm. long, and fingers 0.9 mm. long, separated by an elliptical gape; the cutting edges are concavely excavate, the tips acuminate, meeting, fringed on the outer side by stiff bristles.

The second left leg has the ischium 1.5 mm. long; the merus, 1.5 mm. long; the carpus, first joint, 1 mm. long; second, third, fourth and fifth articles subequal, each being 0.5 mm. long; the propodus has a total length of 0.9 mm., the palm being 0.4 mm. and the fingers, 0.5 mm. long, separated by a narrowed, elliptical sulcus, the tips meeting and setose.

Family: **PALAEMONIDAE**

Subfamily: **Palaemoninae**

Genus: **PALAEMON** Fabricius

Subgenus: **Eupalaemon** Ortmann

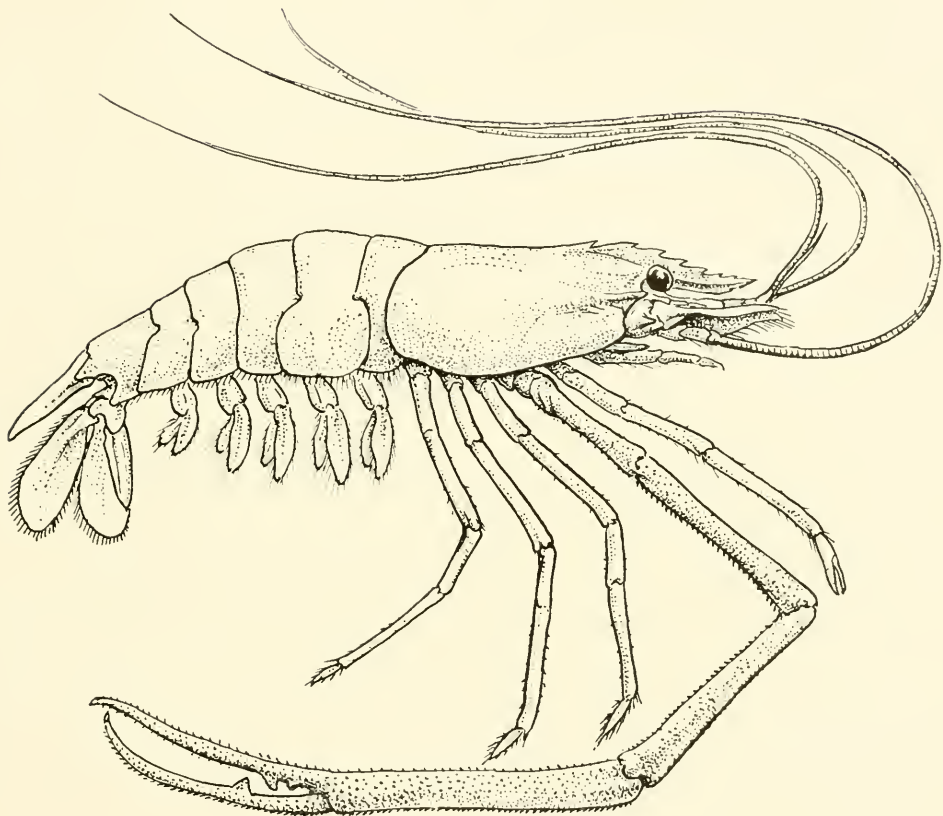
Palaemon (Eupalaemon) lar (Fabricius)

Plate 38

TYPE: Fabricius' type came from India "(Dom. Daldorff)" and, if still extant, is probably in the British Museum of Natural History.

DISTRIBUTION: This species is known from numerous localities in Polynesia and the Philippine Islands and on the east coast of Africa. It has been reliably reported from the following: Philippine Islands, Port Galera, Mindoro, basin of Manila waterworks, San Juan del Monte, Luzon (Cowles); Andai, New Guinea, Moroka (Nobili); Mariannes Islands (Cowles); Halmahera Islands, soft water, Batjan, Tobelo, Makassar, Celebes, Borneo, New Guinea, several localities (de Man); Cape Gazelle, New Britain (Borradaile); Tamavua River, Vitu Levu, Fiji Islands; very common in the upper waters of all the rivers of Fiji; in Tiavieni it was formerly reserved as food for chiefs (Borradaile, Gardner); Samoa (Lenz); Guam (Cowles); Tahiti (Boone); East Africa, Mohele, Pemba Island (Lenz); New Caledonia, several localities (Roux).

MATERIAL EXAMINED: Thirty-two specimens from brackish stream, Papeete, Tahiti, Society Islands, August 16, 1931. One female taken on Venus Point Reef, Tahiti, August 15, 1931.



Paluemon (Eupalaemon) lar Fabricius, about five-sixths of natural size.

TECHNICAL DESCRIPTION: Carapace, including the rostrum, five-sixths as long as the abdomen, including the telson. The rostrum, measured from the orbital angle to the tip, equals one-half or slightly more than one-half of the length of the carapace. The carapace is laterally compressed, rounded above, the distal two-fifths produced to a crest which is continuous with the rostrum; the rostrum is blade-like, directed forward, slightly downward, with the tip slightly upward directed. The superior margin of the crest is cut into one acute, procurved tooth on the gastric region at the origin of the crest on the rostrum and followed usually by seven (sometimes eight, rarely six) similar teeth, well spaced; the eighth tooth sometimes being well back from the acute tip and sometimes very close to it. Anterior to each tooth on the margin of the rostrum is a fine brush of cilia. On the inferior margin of the rostrum there are usually three teeth (sometimes two, rarely four), the proximal one being about opposite the base of the second peduncular joint and the distal one opposite the next two distal teeth of the upper series. The superior orbital margin is lightly carinate and this carina continues forward on the lateral surface of the rostrum, vanishing near the tip. The outer orbital canthus is rounded and the anterolateral angle is also rounded and unarmed. There is a short, acute, hepatic spine, and slightly above it a short carina that runs obliquely forward and upward, terminating in an acute spine, just below and distinct from the rounded optic canthus. Below and posterior to the hepatic spine there is a distinct short sulcus extending backward obliquely. The abdomen is compact, dorsally rounded and unarmed. The epimera of the first segment are bluntly rounded, those of the second segment are widely rounded, expanded, overlapping those of the two adjacent segments; the epimera of the third segment are narrow, bluntly rounded; the epimera of the fourth, fifth and sixth segments are truncated, with the postlateral angles increasingly acute. The fourth and fifth segments are slightly incised on each side posteriorly in the median lateral region; the sixth segment is produced in this region into an acute small triangle that projects above the outer lateral portion of the telson. The telson is one and two-thirds times as long as the sixth segment, rounded on the upper surface, narrowed distally, the distal margin triangulate, armed on either side with an inner pair of large triangulate, articulate spines extending somewhat beyond the tip of the

telson and an outer small pair of triangulate spines, one each at the base of the telsonic margin. The median distal margin of the telson, between the pair of larger spines, is beset with thick longish bristles. On the distal half of the dorsal telsonic surface there are two pairs of well spaced, acute, articulated spines, in longitudinal series; the ventral surface of the telson is a deep trough. The uropoda are nearly one-third longer than the telson; the peduncle is short, produced into a laminate, triangulate point at the base of the outer blade; the outer blade is wider and slightly longer than the inner blade and more evenly rounded distally, with the outer margin thickened and tapered to an acute subdistal tooth; the inner blade is more narrowed distally and somewhat unequally tapered.

The eye is set obliquely upon a short stalk and is hemispherical with a small ocellus beyond the corneal margin.

The antennulae are not quite as long as the antennae and have the peduncular articles not quite so long as the rostrum, terminating about opposite the predistal rostral spine. The first article is expanded, concave beneath the eye and laminate distally, with the outer lateral margin thickened and armed with a small acute tooth proximally and a stronger acute tooth distally; the inner distal margin is bluntly rounded and ciliate; the second article is thickish, cylindrical, produced into a thick, triangulate tooth at the outer distal angle and a similar but more cylindrical tooth at the inner distal angle; both projecting beside the base of the third article, which is smaller, cylindrical; the flagellum is three-branched, multiarticulate, the superior branch being decidedly the thicker one proximally.

The antennae have the basal article thick, with a blunt rounded upper margin succeeded by an acute tooth at the outer lateral angle; the second and third articles lie beneath the scaphocerite, together extending about midway its length; the multiarticulate flagellum is very long. The scaphocerite is very large, with the tip extending slightly beyond the rostrum. The outer margin of the scaphocerite is nearly straight, thickened, and terminating in an acute subdistal spine; the distal margin is rather evenly rounded and the inner lateral margin is moderately convex, widening toward the proximal portion. The outer half of the dorsal surface of the scaphocerite is emphasized by the longitudinal carinae,

separated by a distinct sulcus, all of which are terminated by the oblique sulcus that runs inward from the lateral tooth.

The first pair of legs is exceedingly slender, and when extended reach beyond the rostral tip by about the distal third of the carpus and the entire propodus and dactyl. The basis and ischium are successively longer, each produced on the inferior lateral margin into a laminate marginally-rounded process, thickly beset with short bristles. The merus is slender, cylindrical, greatly elongated, extending to midway the scaphocerite; the carpus is even slenderer and about one-fourth longer than the merus; the propodus, including the finger, is two-fifths as long as the carpus, similarly slender; the finger is about as long as the palm, sub-cylindrical, tapered, with the tip pointed; the upper finger is similar to the lower one but a little slenderer, with the distal half of the cutting edge faintly crenulate; both fingers are beset with numerous isolated tufts of bristles on both their lateral margins; on the inner proximal lower margin of the palm there is a curious double series of short bristles; on the distal end of the carpus there is also a brush of related bristles. The leg is bent at the mero-carpal joint.

The second pair of legs is greatly elongated, being one and one-half times as long as the entire body in a specimen about 4.5 inches body length. The coxa is strong; the basis produced to a supporting triangulate process at the inferior distal angle; the ischium is elongated, compressed cylindrical, thickened distally; the merus is twice as long as the ischium, moderately dilated distally; the carpus is almost as long as the merus, similarly dilated distally; the propodus has the palm one and two-fifth times as long as the carpus, regularly cylindrical, somewhat compressed laterally, with the lower finger two-thirds as long as the palm, tapered with an upcurved, acute tip, extending beyond the down-curved tip of the upper finger and armed with a large triangulate subdistal tooth, and near this a smaller inner basal tooth, which is rounded, laminate. The upper finger is slenderer, shorter, with down-curved, acute tip; basally there are two or three rudimentary small teeth, and about one-third of the length from base is a large triangulate tooth, not touching the lower finger, because of the elliptical gape, which is nearly twice as wide in the widest place as either finger. The ischial, meral, carpal, propodal and dactylar joints are armed with numerous small, acute, procurved

spines, which on the inferior margin of the carpus, propodus and dactyl become much more numerous.

The third, fourth and fifth pairs of legs are similar, subequal, very slender, with the merus slightly longer than the carpus; the propodus twice the length of the carpus; the dactyl short, unguiculate, with a brush of bristles. These legs are finely setose.

The pleopoda are biramous, subfoliacious, excepting the reduced first pair, with the blades subequal. The first pair of pleopoda has the inner branch pointed, only about half as long as the outer branch.

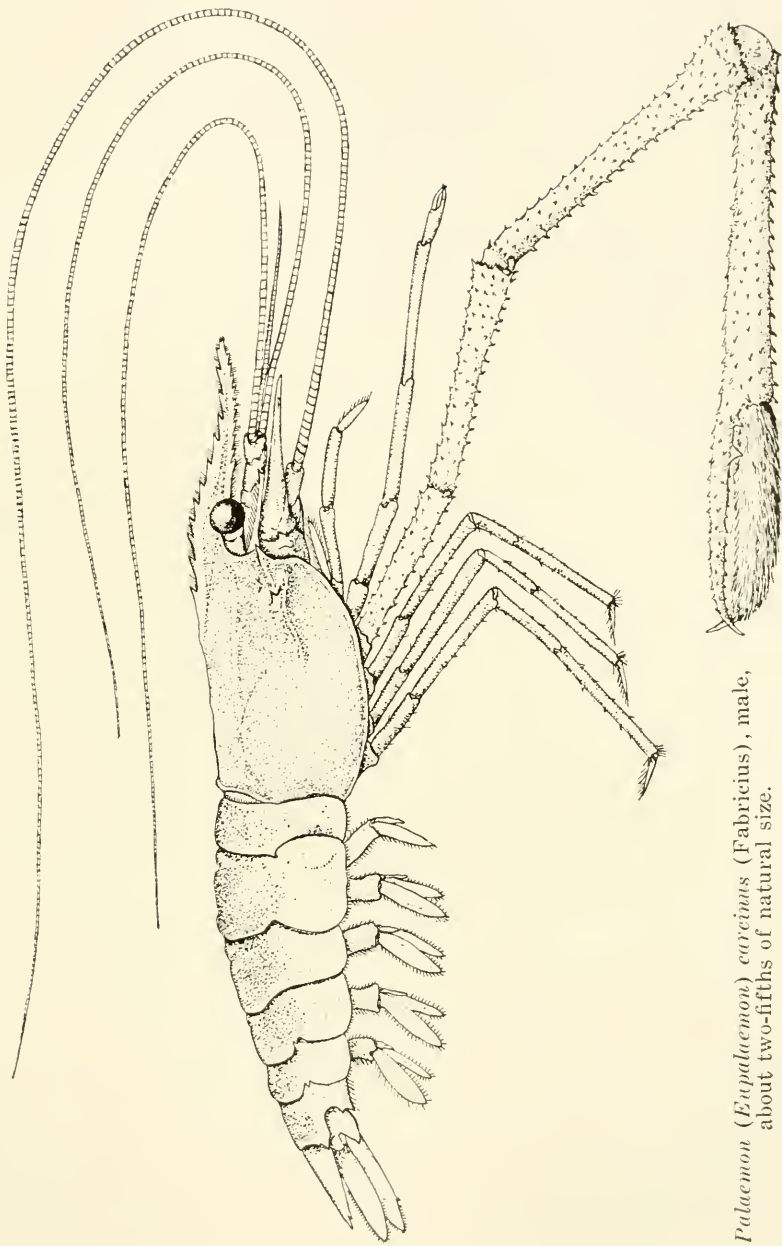
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Palaemon (Eupalaemon) carcinus (Fabricius)

Plate 39

TYPE: Fabricius' type came from "America" and, if still extant, is probably in the British Museum of Natural History.

DISTRIBUTION: This species is reliably known from India to New Guinea and the Philippine Islands, where it is apparently quite abundant. It has been recorded from the following localities:



Palaemon (Eupalaemon) carcinus (Fabricius), male,
about two-fifths of natural size.

India: From many localities in the Malabar District, Cochin State, Travancore State, Godaveri District, Rajahmundry and Cocanada, Chingleput District, Red Hills, and other localities near Madras; from salty water, backwaters of Cochin State near Ernakulam. Salt water records for this species are very rare (Henderson and Mathai). A large series, from Bombay, Ganjam, Calcutta, Sunderbunds, Sittoung, Burma (Henderson); Tavoy (Day); Burma (Oates); Chilka Lake, Orissa coast, and Garia, near Calcutta (Kemp); Patani River (Kemp); Malay Peninsula, freshwaters of Patalung River, from market, at Lampam; Singgora, Tale Sap (Kemp); Tale Sap (Lanchester); Indo-China, Saigon, Bangkok, Siam (de Man); Java, Bali (Miers); Mergui (de Man); Halmahera Islands, Tobels, Borneo (de Man); numerous localities in the Philippine Islands (Cowles); Kalau, New Guinea (Nobili).

MATERIAL EXAMINED: Three large specimens, male and female, from Georgetown, Penang, Malay Straits, November 18, 1931.

TECHNICAL DESCRIPTION: Adult male: The rostrum is long, extending beyond the scaphocerite by about one-fifth of its length, deflected toward the median portion and thence curved upward; rostral formula of dentition, twelve to sixteen on the superior margin and ten to fourteen teeth on the inferior margin, with the proximal two or three teeth on the carapace; these separated more from one another than are the others. Adult female: The rostrum is less deep than in adult males, but is usually more strongly up-curved distally than in males. The carapace is stout, with a strong antennal spine, which is buttressed posteriorly by a short ridge. Immediately behind this there is a second acute, but smaller, spine. The anterolateral angle is rounded. The abdominal terga are compact, with rounded dorsum. The telson is elongated, narrowed distally with an acute tip, armed with an inner pair of subterminal spines, which are longer than the related pair of outer subterminal spines, but are shorter than the apex of the telson. The uropoda are those typical of this genus.

The first three pairs of legs are chelate. The first pair is small and quite slender and affords no diagnostic features.

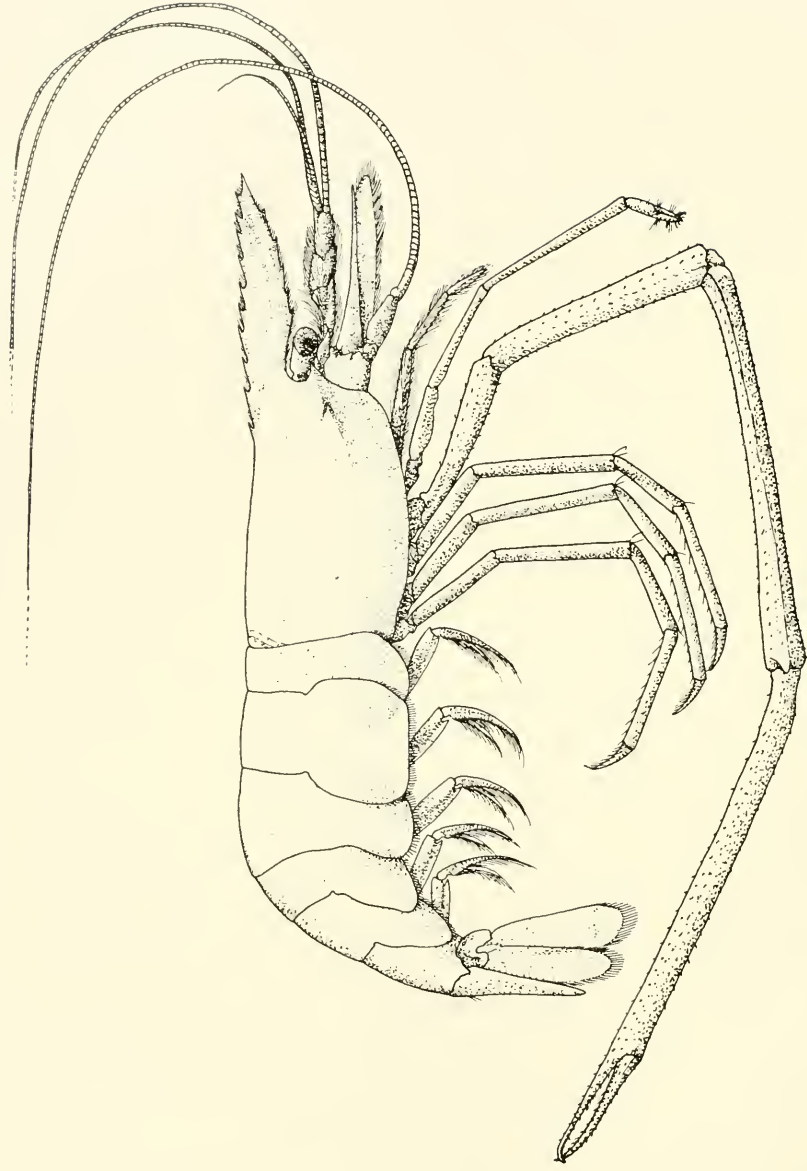
The second pair of chelipeds is greatly developed. In an adult male, they are one and one-half times the length of the entire body, while in an adult female these second chelipeds are half to

two-thirds the length of the entire body. Those of the male are subcylindrical; the ischium, merus, carpus, propodus and dactyli are beset with coarse, broad-based, prickly spines, which along the joints and on the upper and lower lateral margins are stronger, being more abundant here and sharper. The spines are much weaker on the fixed finger and are reduced to rough denticles on the movable finger, which has a dense, short, coarse pilosity. The carpus is clavate, as wide distally as the palm, which is of uniform width. The fingers are two-thirds as long as the related palm, very tapered, the upper one being slightly the thicker, but superficially appearing more so, because of its pilosity, the tip is very curved, the apex only touching upon the less curved but acuminate tip of the lower finger. The lower finger bears two or three small, triangular teeth, and following these but set well apart is a large, triangular tooth. The upper finger has two such large teeth, one on either side of and well separated from the opposed tooth of the lower finger. In the adult female, the chelipeds are weaker, the inequality between the fingers and related propodi is less and the small spines are weaker.

The third pair of legs is greatly reduced, but are somewhat longer than the first pair.

The fourth and fifth pairs of legs are slender, monodactylar.

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Palaeomon (Eupalaeomon) acmulus Nobili, $\times 1.3$.

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Subgenus: *Parapalaemon* Ortmann
Palaemon (Paralaemon) aemulus Nobili

Plate 40

TYPE: Dr. Nobili's type series consisted of an adult male and a female, collected at Gatawake, Paumotu Islands, and deposited in the Paris Museum.

DISTRIBUTION: This species is known from the type locality, Paumotu Islands (Nobili); and from ten localities in New Caledonia (Roux), to which the "Alva" specimen adds another, Noumea, New Caledonia (Boone).

MATERIAL EXAMINED: One female, collected at New Caledonia, September 19, 1931, by the "Alva."

TECHNICAL DESCRIPTION: Adult female, body length, rostrum included, 110 millimeters. Carapace compact, smooth, rounded on the posterior three-fifths, with the anterior two-fifths elevated into the rostral carina; its rostrum is about half as long as the carapace with a distinct moderate double curvature, armed on the upper margin with eight, and on the lower margin with five, teeth, and with the carina of the fronto-orbital margin continuous with a lateral carina on the rostrum which extends to about the predistal upper tooth. The antennal spine is acute with its buttress not quite reaching the margin and extending backward a short distance as a carina; a second, smaller, but acute spine, occurs immediately behind the first antennal spine. There is no other hepatic spine but a small depression defines this region. The anterolateral angle is slopingly rounded and the lateral margin is emphasized by a flat carina. The abdominal terga are compact, smooth, the first five segments with the lateral margins regularly rounded; the postlateral angle of the sixth segment produced into an acute tooth outside of the base of the uropoda and into a slightly less acute triangle above the base of the telson. The telson is one and a half times as long as the sixth segment and tapered, the apex is pointed and armed with a submedian pair

of long, articulated spines, and outside of these a pair of short spines, one each on either side; the inferior distal margin of the telson is fringed with bristly setae; the median dorsal surface of the telson is abundantly covered with rounded granules, some of which are more sparsely distributed on the lateral regions. The uropoda are slightly longer than the telson, with the inner blade slightly the smaller and having its dorsal surface covered with granules similar to those of the telson; both blades are widely oval.

The eye is pyriform with a small ocellus.

The antennulae have the peduncle two-thirds as long as the scaphocerite; the basal article is concave beneath the eye and has the outer lateral margin thickened, terminating in a distal spine; the second and third articles are successively shorter; the flagellum is three-branched, the shortest branch is one-half as long as the second branch, which is three-fourths as long as the third branch, and the latter is three-fourths as long as the antennal flagellum, which is three times as long as the entire body.

The antennae have a double spine on the outer lateral-distal margin of the first article which supports a typical scaphocerite, which has a thickened outer lateral margin that terminates in a sharp spine and has the inner distal portion rather widely rounded.

The external maxillipeds are each two-thirds the length of the scaphocerite, with the dactyl about two-thirds as long as the preceding article, pointed and beset with setae.

The first pair of legs are exceedingly slender and extend beyond the scaphocerite by slightly more than the length of the propodus and dactyl.

The second pair of legs (female) are about three times the length of the carapace, including the rostrum, and are quite slender, with the ischial joint about two-thirds as long as the merus; these two articles considered together are about equal in length to the carpal joint, which is as long as the slender palm. The fingers are almost one-third as long as the palm, very slender, with an upper and a lower triangulate tooth on the proximal portion, and with tapered, hook-like tips that interfit. The meral, carpal, propodal and dactylar joints are beset with coarse, broad-based, prickly tubercles or spines, like those figured by M. Roux.

The third pair of legs is greatly reduced, slender, chelate, about; longer than the first pair.

The fourth and fifth pairs of legs are monodactyl, similar, with the dactyl acuminate, less than one-third of the length of the propodus.

REFERENCES: *Palaemon* (*Parapalaemon*) *aemulus*, NOBILI, G., Bull. Paris Mus. Nat. Hist., t. XII, 1906, p. 258; Mem. R. Acc. Sci., ser. 2A, t. LVII, 1907, p. 362, pl. 1, figs. 5a-b.—ROUX, J., and SARASIN, F., Nova Caledonie: Recherches Sci. en Nouvelle Caledonie et aux Iles Loyalty. A. Zool., t. IV, Livr. II, 1926, p. 221, text figs. 47-51, Munchen.

Subfamily: Pontoninae

Genus: VANDERBILTIA, new

Rostrum a broad depressed process with deflexed apex encupping the orbit and projecting down on the frontal surface of cornea. Carapace glabrous, devoid of sulci or spines. Eyes with stalk concealed by carapace; cornea large, well developed. Antennulae with basal article laminate; flagella fleshy, as in *Palaeomoninae*. External maxillipeds pediform, with slender exognath. Mandible with two-jointed palp. Antennae with well-developed scaphocerite. First pair of legs weakly chelate, carpal joints unsegmented. Second pair of legs chelate; propodus expanded, somewhat operculiform; dactyli bi- or tri-unguiculate; epipodite present, well developed. Third pair of legs ambulatory; dactyli biungulate, inferolateral margin with accessory spinules in series; a long slender epipodite present. Fourth pair of legs like the third but without an epipodite. Fifth pair of legs of similar structure to preceding pairs, except that the dactyl is thickened with a basal protuberance, or "hoof"; no spines present on the inferolateral margin; no epipodite present. Abdominal segments glabrous, resembling *Sergestes*, sixth abdominal segment one and a half times longer than the fifth. Telson longer than the preceding segment, with three pairs of spines dorsally and three pairs of spine-like bristles distally. Uropoda longer than telson; outer blade with subdistal tooth and transverse suture beset with denticles in continuous series.

First pair of pleopoda of male with well-developed petasma, consisting of paired organs, united in the median line, strongly resembling *Peneus*. Remaining pleopoda two-branched, well developed.

This genus is placed in the *Pontoninae* with considerable hesitation. Dissection of additional material and females is necessary to clarify the phylogenetic relationship of this remarkable coral crevice shrimp.

GENOTYPE: *Vanderbiltia rosamondae*, new, from coral, Venus Point Reef, Tahiti, Society Islands; deposited in the Vanderbilt Marine Museum.

Vanderbiltia rosamondae, new species

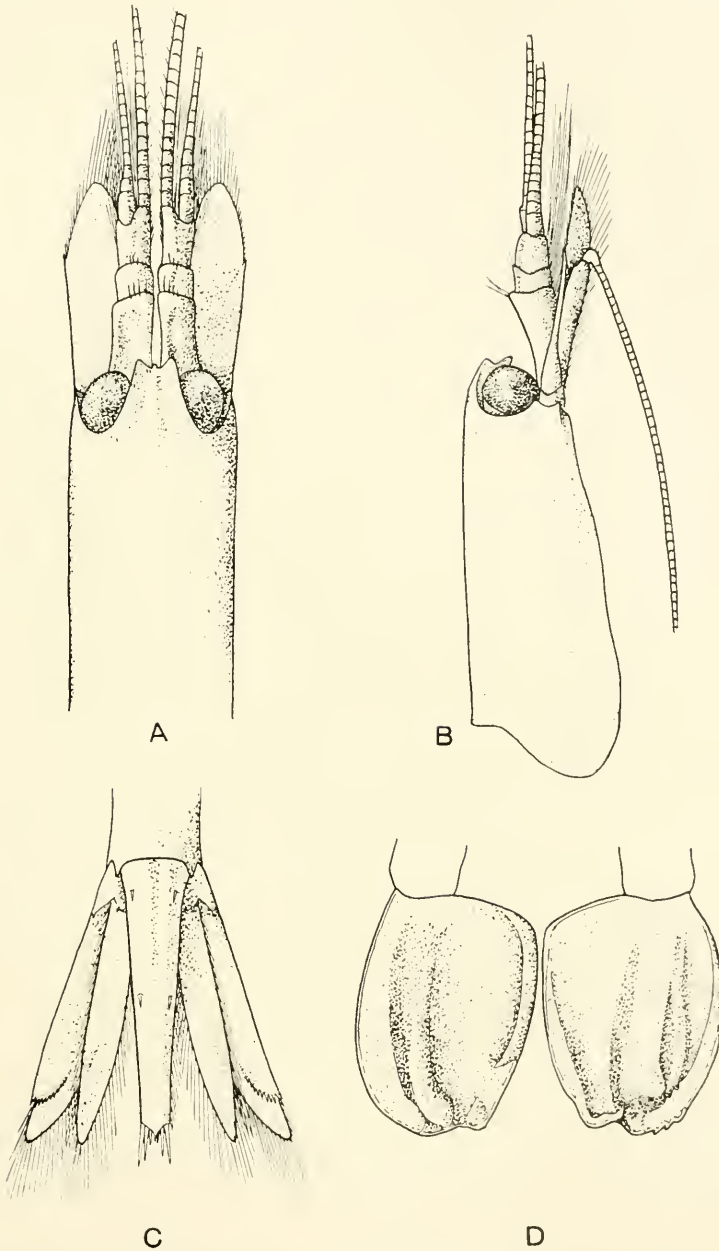
Plates 41 and 42

TYPE: One male, taken in coral, Venus Point Reef, Tahiti, Society Islands, August 15, 1931.

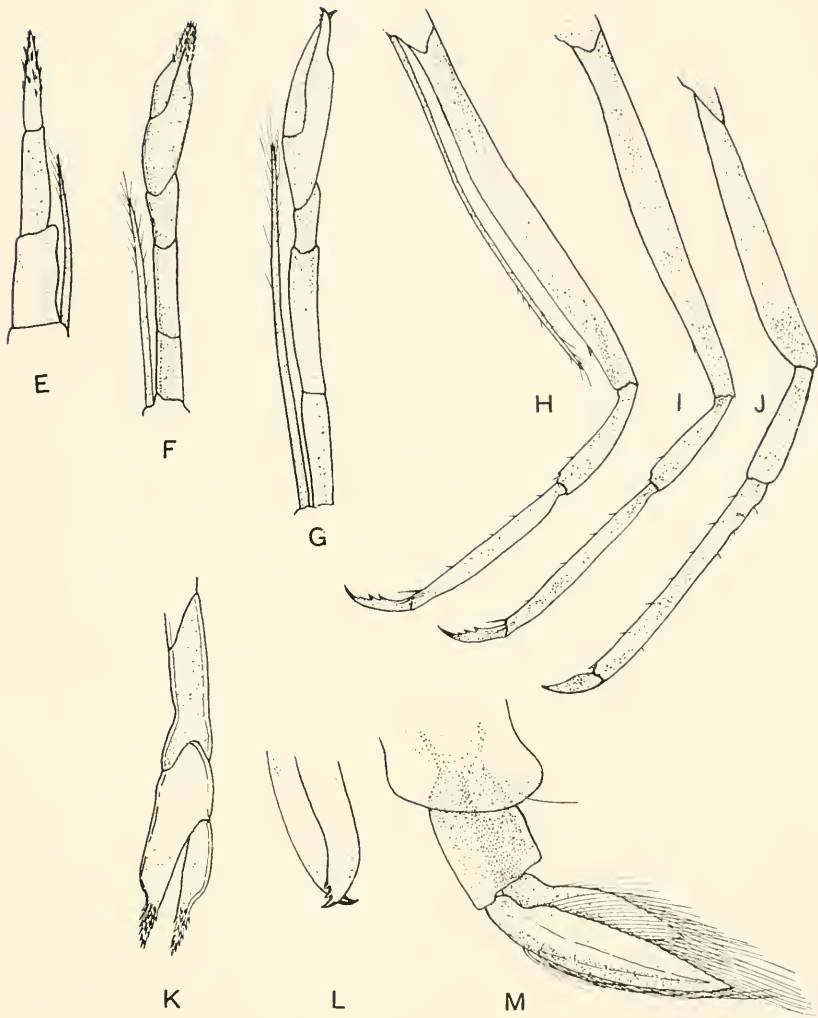
DISTRIBUTION: So far restricted to the type.

MATERIAL EXAMINED: Type.

TECHNICAL DESCRIPTION: Carapace glabrous, slender, typically *Sergestid*, 3 millimeters long, with the rostrum consisting of a concave median process extending between the eyes and as far forward as they do, being one-half as wide as one cornea; extending above the eye with the lateral rostral margin carinate, surrounding the upper side of the eye and distally forming a triangulate denticle, immediately above the anterior margin of the eye, beyond which tooth the rostral apex is decidedly deflected, in an abrupt curve, this tip of rostrum being bent downward to midway the orbit. The dorsal surface of rostrum is a deep wide groove. The infraorbital angle is obscure, the frontal margin of carapace being closely applied here to the antennal base. The anterolateral angle is blunt. The abdominal terga are smooth, dorsally rounded, 8 millimeters long; the sixth segment is one and one-half times as long as the fifth segment, but only five-sixths as long as the telson, which is dorsally convex, tapered distally, triangulate, armed with three pairs of articulate spines on the distal half; the telsonic border bears three pairs of long, spine-like bristles; the apex of the telson extends as far as the subdistal tooth of the outer lateral margin of the uropod blade. The inner blade is a little longer than the telson, narrowly ovate; the outer blade is slightly longer and wider than the inner blade, with a subdistal tooth on the outer margin and a transverse suture extending inward obliquely from the tooth and beset with denticles in series; both blades have the margins crenulated and ciliated.



Vanderbiltia rosamondae, new genus and new species, type: A, dorsal view of carapace and appendages; B, profile of same; C, dorsal view of rhipidura; D, petasma of adult male shown from posterior lateral side, partly opened; all greatly enlarged. The type is about 11 millimeters long.



Vanderbiltia rosamondae, new genus and new species, type, adult male: E, external maxilliped; F, first leg; G, second leg; K, enlargement of distal articles of first leg; L, enlargement of distal end of fingers of second leg; H, third leg; I, fourth leg; J, fifth leg; M, second pleopod; all parts greatly enlarged.

The eye is short-stalked, this stalk being entirely concealed beneath the carapace-rostral region; the cornea is hemispherical, large, not projecting beyond the rostrum and closely surrounded on the upper and outer surfaces by the carinate border of the carapace.

The antennulae have the first peduncular article laminate, flat-tish beneath the eye, the visible portion being about twice as long as wide, or as long as the second and third articles considered together; the second article is short, cylindrical; the third article similar to the second but slightly shorter; the entire peduncle is three-fifths as long as the scaphocerite; the shorter flagellum consists of ten thick, fleshy articles, each about as long as the third peduncular article and following these a slim whip consisting of five or six smaller articles; on the inner and distal margins of the distal ten articles there is a brush of setae; the longer flagellum is also thick, composed of about eighteen setose articles, the distal seven or eight of which extend beyond the scaphocerite.

The antennae have the first peduncular article compact, the second article short, the third article elongate, cylindrical, extending almost three-fifths of the length of the scaphocerite; the flagellum is 4 millimeters long, or one and one-third times as long as the entire carapace. The external maxillipeds are pediform and extend as far as does the tip of the second pair of legs; the distal article is cylindrical proximally, tapered conically, distally, and rough with bristles set in transverse series, those near the apex being especially hook-like; the exopodite is slender and reaches almost to the basal article of the endopodite.

The mandible has a two-jointed palp.

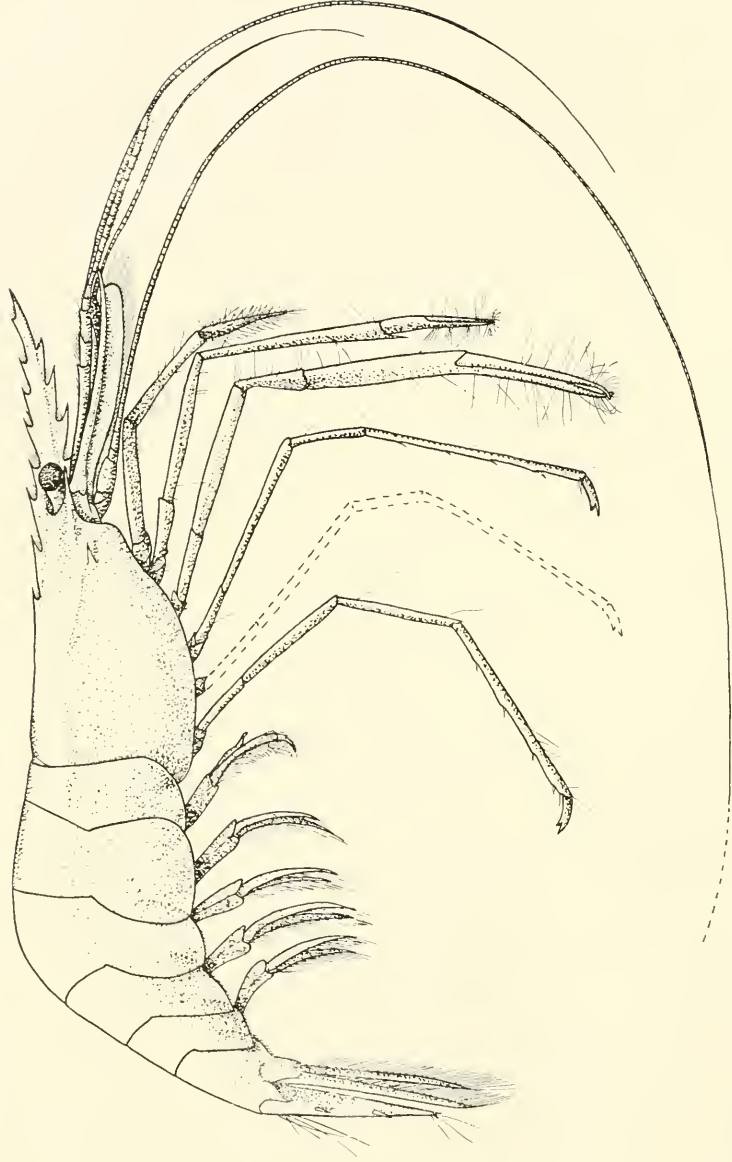
The first chelipeds are weak, the apex of the tips extending as far as does the tip of the rostrum, or to the base of the fingers of the second chelipeds, which are similar.

The second pair of chelipeds is the longer, somewhat operculiform, extending to about midway the distal peduncular joint of the antennae; the merus is extremely slender, elongated, laterally compressed, transparent; the carpus is no wider than the merus and is about one-fourth as long; it terminates obliquely, reinforcing the support to the propodus, which, including the finger, is a little more than twice as long as the carpus, expanded into a slight convex contour on the outer lateral margin, weakly chelate for the distal half of its length, the apex forming a slight curved

hook, which fits into that of the opposed leg; the tip bears also a tuft of bristles. The epipodite is slender, about a third as wide as the meral joint, distally tapered, and extends to the base of the propodus and is beset with long solitary setae on its distal fourth, those at the apex being quite stiff bristles.

The first pair of ambulatory legs bears a long, thread-like epipodite that extends 0.6 of the length of the meral joint. There are no epipodites present on the fourth and fifth pairs of legs, which otherwise resemble the third pair of legs. The third pair of legs has the merus slender, 2.5 mm. long, 0.5 mm. median width, tapered distally; the carpus 0.8 mm. long; the propodus 1 mm. long; the dactyl, unguiculate, 0.4 mm. long, with about three secondary spinules on the inferior lateral margin. The fourth and fifth pairs of legs are successively shorter; neither has an epipodite; the fifth pair also have the dactyl different from that of the third pair of legs, in the absence of articulated spines on the inferolateral margin and in having the dactyl thickened with a hoof-like basal protuberance, resembling *Coralliocaris*, but devoid of the dorsal accessory spinule found in that genus.

The first pair of pleopoda in the male bear a well-developed petasma, strongly resembling *Peneus*. Viewed from the posterior left side, as a whole the petasma has a suboval contour; when unfolded, the right and left sides are shown to be slightly different, the inner lateral margins semiunited and the opposed faces interfitting one upon the other by means of the series of carina-like folds and tooth-like processes shown in the figure. The left half of the petasma has the outer lateral margin convex and folded over on the main portion, forming a semitubular border, the free edge of which terminates anteriorly in a rounded lobe. Inside of this tubular margin, separated from it by a longitudinal sulcus, and extending almost down the center of the organ, there is a second elevated, wide flat process, which also forms a semitubular process and also terminates distally in a rounded lobe, the apex of which is bent inward. Beyond this, the inner half of the organ is a flat plate, except that three-fourths of the inner lateral margin is narrowly convex and folded inward over this flat plate, terminating distally in a triangular process, or tooth, beyond which the inner lateral margin is open for a short distance, thence bears distally, just above the point of attachment of the organ, a small process contiguous with the margin, but with the free edge form-



Palaeomonella longirostris Borradaile, $\times 3$.

ing a triangular tooth bent inward over the margin of the flat main plate. The right half of the petasma is also oval, with the outer lateral portion bent over, convex, forming a wide semitubular border, the free margin of which bears distally, near the point of attachment, a series of three sharp triangular teeth, that interfit with the opposed right side; inside of this tubular region, the main plate is flattish, and bears a strong longitudinal carina on its surface; the inner half of this plate becomes somewhat convex toward the inner lateral margin and bears distally a small lobate process. (See Plate 41, fig. D).

Genus: PALAEMONELLA Dana

Palaemonella longirostris Borradaile

Plate 43

TYPE: Mr. Borradaile's type came from Fadifolu Atoll, Maldive Archipelago, and is deposited in the Cambridge Museum, England.

DISTRIBUTION: Maldive Archipelago (Borradaile); Bali (Boone).

MATERIAL EXAMINED: One specimen from coral, Temukus Roads, Bali, Dutch East Indies, October 25, 1931.

TECHNICAL DESCRIPTION: This species finds its nearest congener in *Palaemonella tridentata* Borradaile, which comes from the western Indian Ocean and Funafuti; from which it is distinguished by several valid characters.

Palaemonella longirostris Borradaile has the carapace compact, the surface smooth, firm, with the rostral crest arising two-fifths of the carapace length from the posterior margin, the rostrum extending forward beyond the carapace as far as does the scaphocerite. The antennular peduncle is only one-half the length of the proportion of the rostrum. There are seven spines dorsally in addition to the apex; the distal third of the rostrum is upward directed, the dorsal teeth are distributed: three on the carapace, the most proximal and smallest tooth of the series being epigas-tric; the second and third spines are successively larger; the fourth, fifth and sixth spines are approximately subequal to the second tooth and are regularly spaced along the proximal three-

fifths of the rostrum; the seventh tooth is distinctly smaller and further apart than the sixth tooth, being nearly subapical, the apex itself is acute; the inferior rostral margin has three teeth placed approximately obliquely opposite the fourth, fifth and sixth spines of the upper margin. The carapace has no grooving. There is no preorbital spine; the antennal spine is strong; the hepatic spine is acute, shorter than the antennal spine.

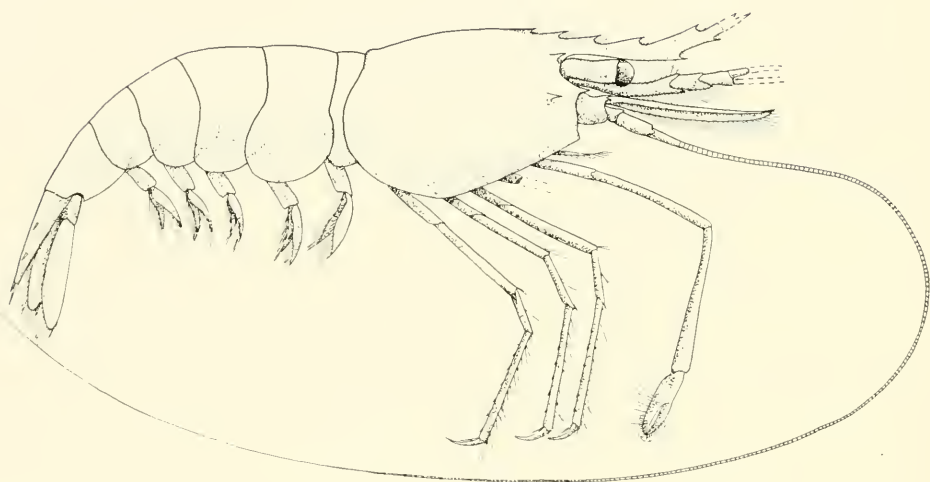
The abdominal segments are compact, the third segment is slightly convex in its median posterior margin; the sixth segment is about one and one-third times as long as the fifth segment, not greatly elongated, and produced into a median lateral triangulation on either side of the telson. The telson is one and three-fourths times as long as the sixth segment; with a median longitudinal sulcus dorsally, margined by paired dorsolateral longitudinal low ridges on which are two pairs of articulated short spines, a third similar pair of spines being distal in position; the distal telsonic margin is a shallow triangle, armed with a pair of submedian long spines, and between these are six to eight long, coarse, multispinose bristles. The uropoda are longer than the telson, moderately large, ovate distally, the outer blade with a subdistal tooth on the lateral margin, from which point the suture curves inward. Both blades have the margin heavily fringed with cilia.

The eye is set upon a short conical stalk of less depth than the large hemiovoidal black cornea, which is somewhat obliquely placed, with excellent visual range in all directions.

The antennulae have the first peduncular article elongate, expanded beneath the eye; the second and third articles are cylindrical, subequal; the flagellum is two-branched with the outer branch deeply cleft, the proximal portion thickened and pilose; the inner branch is the longest of the three.

The antennae have the basicerite strong; the scaphocerite is almost as long as the rostrum, and of moderate length, with the outer lateral margin thickened and terminating in an acute spine which extends beyond the inner distal portion, which is transversally truncate, very slightly convex at the inner distal angle and with the inner and distal margins fringed with setae.

The mandibles carry a palp. The second maxilliped has no podobranch. The third maxilliped is narrow and bears a vestigial arthrobranch.



Periclimenes (Ancylocaris) spiniferus de Man, $\times 6$.

The first pair of legs are chelate, moderately long, *with the carpus one and one-half times as long as the related hand*, an item which sets this species apart from *P. tridentata*. The fingers are slender, slightly longer than the palm, tapered, meeting throughout their length and set with numerous tufts of bristles on both lateral surfaces near the tips.

The second pair of legs or great chelipeds are distinctly larger than the first and differ also in that the carpus, which is obconic is only one-half as long as the merus, or one-half as long as the palm, which is compressed cylindrical, not dilated, being somewhat higher than wide; the spine at the distal upper end of the merus is quite small; the fingers are slender, as long as the palm, tapered, with tips overlapping, meet throughout their length; the cutting edge of each finger is produced along the outer margin into a laminate carina which, on the upper finger, bears a low molar proximally, and on both fingers is finely, irregularly serrate. The fingers are also beset on both lateral faces along the margins of the cutting edges with long bristles, near the tip these become more numerous, intermeshing, sieve-like.

The third, fourth and fifth pairs of legs are very slender, with elongated ischium and merus, the ischium is 0.6 as long as the merus; the carpus is 0.5 as long as the merus and produced into a blunted process on the dorsal side; the propodus is twice as long as the carpus and is armed on the inferior lateral margin with six rather widely spaced, slender, acute, articulated spines; the dactyl is approximately one-sixth as long as the propodite and is slender, curved and definitely biungulate, the two distal apices being very strong, the inferior one only a trifle shorter than the superior outer apex.

REFERENCES: *Palaemonella longirostris*, BORRADAILE, L. A., Ann. Mag. Nat. Hist., ser. 8, vol. XV, p. 210; Trans. Linn. Soc. London Zool., ser. 2, vol. XVII, 1914-21, p. 359, pl. 53, fig. 5.

Genus: PERICLIMENES Costa

Subgenus: Ancylocaris Schenkel

Periclimenes (*Ancylocaris*) *spiniferus* de Man

Plate 44

TYPE: Dr. de Man's type series, originally described as a subspecies of *P. petithouarsii* Audouin and Savigny, was collected

at Pulo Edam, Bay of Batavia; Amboina and Ternate, and is deposited in the Leyden Museum.

DISTRIBUTION: This species, as restricted by Mr. Borradaile, has in addition to the above cited localities, been reported from several localities in the Red Sea by Dr. Nobili, i. e., Massauuah, Djibouti, Perim and Tamatave Reef, Madagascar (Lenz); also from the Indian Ocean (Borradaile); Ternate (de Man) and Samoa (Kemp). The "Alva" specimen from Pago Pago, Samoan Islands, appears to be the second record of this species from this archipelago.

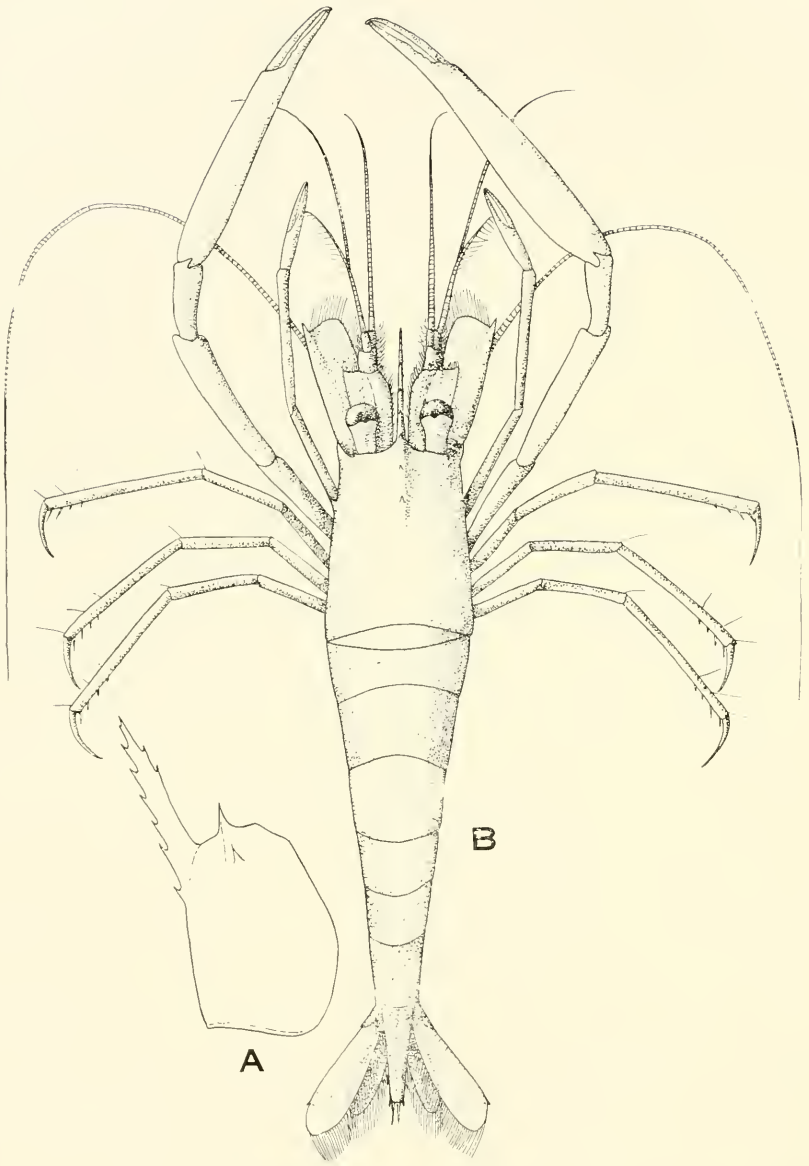
MATERIAL EXAMINED: One specimen from Pago Pago, Samoa, September 2, 1931.

DISCUSSION: Although the "Alva" specimen is unfortunately mutilated, having the tip of the rostrum broken, the second pair of legs missing and also the last two abdominal segments somewhat broken, sufficient evidence remains to permit the reliable identification of the specimen. The specimen conforms in all essentials to Mr. Borradaile's excellent figures of the species (Percy Sladen Trust Expedition Report, Plate 52, fig. 1a).

The carapace is slender, compact, semitranslucent, produced in the median dorsal line to a dentate rostral crest, continued distally as a slender, dorsally concave, distally upward-directed rostral blade, the apical portion of which is broken; the remainder of the upper margin bears six spines, one epigastric in position, the second above the eye, followed by three more in subequal series; somewhat more separated from these is a sixth weaker tooth, near the broken tip. The inferior rostral margin is set with three teeth on the distal portion. The preorbital spine is strong, acute. The hepatic spine is well developed. The eye is large, bulbous. The antennulae are identical with those of Mr. Borradaile's figure. The basal peduncular article is half of the length of the scaphocerite and is moderately incised. The antennae have the scaphocerite almost as long as the rostrum, slender, the outer margin concave, terminating in an acute tooth, the inner distal portion rounded. The carapocerite is slender, cylindrical; the flagellum is between two and three times as long as the entire body.

The mouthparts are like those figured by Mr. Borradaile.

The first left leg is present and has the chela slender, with the fingers longer than the palm and beset with fine, comb-like teeth along the cutting edges.



Harpilius lutescens Dana
A, dorsal view; B, profile of carapace, both $\times 8.6$.

The second pair of legs is missing.

The third, fourth and fifth pairs of legs are similar, exceedingly slender; the propodite is armed with five articulated spines along the inferior lateral margin; the dactyl is unguiculate, curved, acuminate.

The third abdominal segment has the posterior contour as figured by Mr. Borradaile. The remainder of the abdomen of the Samoan specimen also conforms to the description.

REFERENCES: *Anchistia inaequimana*, HELLER, C., Reise. Osterreich. Fregatte "Novara," Rept. Zool., Th. II, Abt. III, 1865, p. 109.

Anchistia Petitthouarsii, DE MAN, J. G., Arch. f. Naturg., Bd. 53, 1887, p. 54.

Periclimenes petitthouarsii variety *spiniferus*, DE MAN, J. G., Abhandl. Senck. Naturf. Gesellsch., Bd. XXV, heft III, 1902, p. 824.

Periclimenes Petitthouarsii variety *spinigera*, NOBILI, G., Ann. Sci. Nat. Zool. Paris, ser. 9, t. IV, 1906, p. 49.

Periclimenes Petitthouarsii variety *spinifera*, LENZ, H., in Voeltzkow's Reise in Ost.-Afrik. Wiss. Ergebn., Bd. II, 1910, p. 567.

Periclimenes (Falciger) spiniferus, BORRADAILE, L. A., Trans. Linn. Soc. London, Zool., vol. XVII, 1917, p. 1924.

Periclimenes (Ancylocaris) spiniferus, KEMP, S., Rec. Indian Mus., vol. XXIV, 1922, p. 195.

Genus: *HARPILIUS* Dana

Harpilius lutescens Dana

Plate 45

TYPE: Dana's type came from the reefs of Tongatabu and is deposited in the Philadelphia Academy of Natural Sciences.

DISTRIBUTION: Tongatabu (Dana); Red Sea, Erythraea (Nobili, Kemp); Tahiti, Society Islands (Boone); Marquesas Islands (Boone).

MATERIAL EXAMINED: Three specimens, taken on Venus Point Reef, Tahiti, Society Islands, August 15, 1931. One specimen, coral reef, Anaho Bay, Nuka Hiva, Marquesas Islands, August 10, 1931.

TECHNICAL DESCRIPTION: The largest of the Tahiti specimens, taken by the "Alva," has the following measurements: Rostrum, 2 mm. long from tip to the orbital angle; carapace, 2.5 mm. long from orbital angle to posterior margin; abdomen, 6.5 mm. long; great cheliped: merus, 2.6 mm.; carpus, 2.5 mm.; propodus and dactyl, 4.6 mm. long, the dactyl being 2 mm. of this total. The carapace is nearly cylindrical, rather compressed laterally, with the distal two-fifths produced in the median line to a decided rostral carina that continues beyond the orbital angle as a laminate blade directed obliquely upward at a decided angle and ornamented on the upper margin with six acute teeth, in addition to the acuminate tip, the proximal two of these teeth are above the carapace, the remaining four being subequally spaced, two above the eye and the remainder near the acute tip. There are two similar teeth on the distal portion of the lower margin of the rostrum, one each opposite the distal two teeth of the upper margin. The lateral carina curves behind the orbit, distinct from the margin. The hepatic spine is very acute and set well back on the carapace. The antennal spine is longer than the hepatic and similarly acute. The abdominal terga are smooth, very much compressed laterally; the sixth segment is no longer than the fifth, or is about two-thirds as long as the telson, which is much narrowed distally, with rounded, ciliate apex. There are three pairs of submedian articulated spines on the convex dorsal surface of the telson. The uropoda have both blades narrowed, ovate, the outer blade being the longer and both successively longer than the telson.

The eyes are conspicuous, set upon short, bulbous stalks, with the cornea distal, convex; visual range mostly directed forward. The eyes do not extend laterally beyond the carapace.

The antennulae have the first peduncular article wide, laminate, extending beyond the cornea and having a distal and a subdistal spine on the outer lateral margin; the second and third articles are successively smaller, cylindrical, and extend two-thirds of the length of scaphocerite, or about as far as does the rostrum; the flagellum is two-branched, each branch is finely articulated and extends about one-third of the length of the palm of the great chelae.

The antennae have the basal article with a small, acute tooth at the outer distal angle; the scaphocerite is extended almost as far forward as does the distal end of the merus of the second cheli-

peds, being nearly half as wide, at its greatest or median width, as long; the inner lateral convex margin being much wider on the proximal half and correspondingly narrowed distally, the distal margin being nearly truncate, very little rounded; the outer lateral margin is nearly straight with the distal tooth acute and decidedly extended beyond the inner distal margin. The second and third articles are slender, rod-like, cylindrical, together extending not quite so far as does the scaphocerite. The flagellum is very fine, thread-like, extending beyond the great chelipeds for a distance equal to one and one-half times the length of these legs.

The first pair of chelipeds is very weak, slender, the tips of the weak, pointed dactyli barely reaching to the base of the propodi of the second pair of legs.

The second pair of chelipeds is also remarkably slender for these appendages, all joints except the propodi being stick-like in their compressed slimness. The ischium is five-sixths as long as the merus and projects as far forward as does the distal angle of the basal antennal article; the merus is trigonal, with an acute, subdistal spine at the inferior angle; the carpus is nearly as long as the merus, but is quite narrowed proximally and widened a little distally, having a tooth at the inferior distal angle and a longer subdistal spine at the upper and slightly inner angle. The propodus has the palm rather evenly dilated, compressed cylindrical, the maximum width of the palm being nearly one-third of the length; the fingers are half of the length of the palm and are quite slender, with the cutting edges meeting, several obscure, sinuate, teeth present, the tips definitely deflected and moderately incurved; small tufts of setae occur near the tips of both fingers.

The ambulatory legs are slender; the propodi carry articulate spines in longitudinal series on the inferior lateral margin; the dactyli are scarcely one-fourth as long as the propodi, curved, acuminate, with no accessory spine on the inferior margin.

REFERENCES: *Harpilus lutescens*, DANA, J. D., U. S. Explor. Exped. Crust., vol. XIII, pt. 1, 1852, p. 576; Atlas, 1855, pl. 38, fig. 4.—BORRADAILE, L. A., Ann. Mag. Nat. Hist., ser. 7, vol. II, 1898, p. 386.—NOBILI, G., Ann. Mus. Napoli, I, t. III, 1901, p. 3; Ann. Sci. Nat. Zool., Paris, ser. 9, t. IV, 1906, p. 63.—BORRADAILE, L. A., Trans. Linn. Soc. Zool., ser. 2, vol. XVII, 1914-21, p. 381 (this article printed September,

1917).—KEMP, S., Records Indian Mus., vol. XXIV, 1922, p. 235, figs. 72, 73.

Genus: CORALLIOCARIS Stimpson

Coralliocaris superba (Dana)

Plate 46

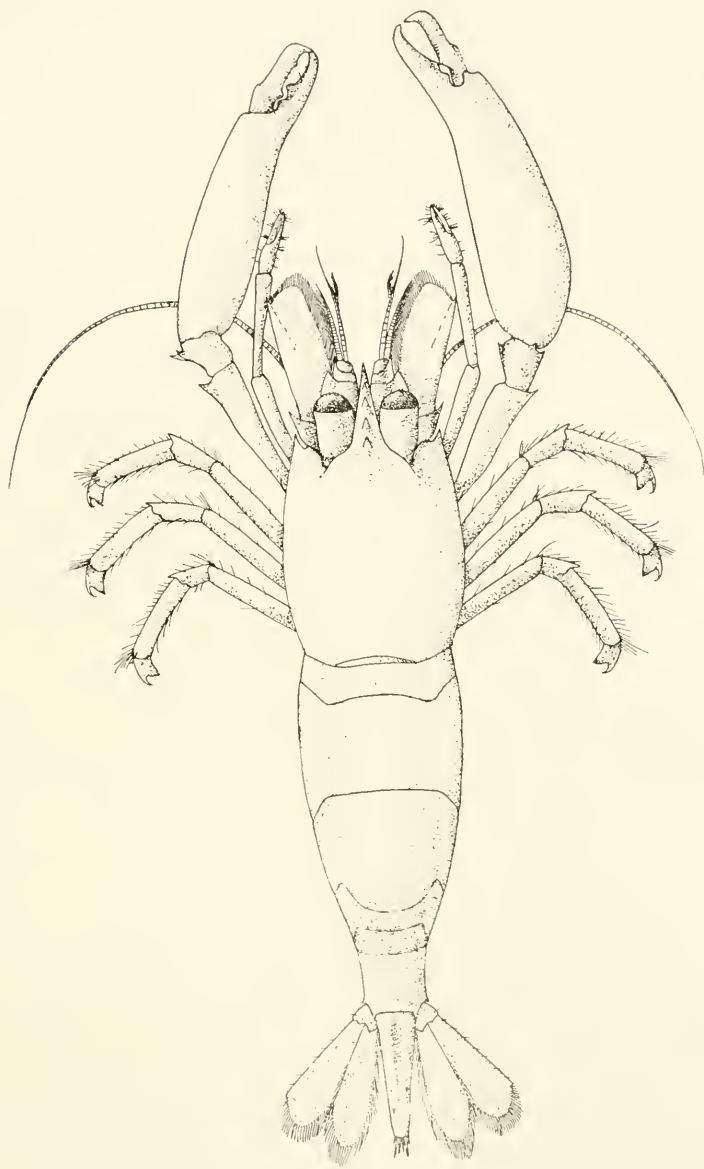
TYPE: Dana's type was taken in the "Pacific among the growing corals of Tongatabu" and is deposited in the Philadelphia Academy of Natural Sciences.

DISTRIBUTION: Red Sea, several localities (Nobili, Balss, Tattersall); south coast of Arabia (Balss); Port Blair, Andamans (Kemp); Nordwachter Island, Pulo Edam Island, Bay of Batavia (de Man); Bali (Boone); Christmas Island (Calman); Bonin Islands (Balss); Tahiti (Stimpson, Boone); Tongatabu (Dana).

MATERIAL EXAMINED: Three specimens taken in coral, Teviatoa Reef, Raiatea Island, Society Islands, August 21, 1931. One specimen, Venus Point Reef, Tahiti, Society Islands, August 15, 1931. One young specimen, Bali, in coral, Temukus Roads, October 25, 1931.

COLOUR: Dana states: "Color mostly opaque white, with a bluish, yellowish or flesh tinge; antennae and scales, eyes, feet and posterior part of the body from the fourth abdominal segment, transparent wine-yellow or burnt sienna, dotted with brown; extremity of caudal segment and lamellae purple."

TECHNICAL DESCRIPTION: Carapace very broad, depressed and lightly rounded; length, including rostrum, 5 mm.; median width, 3 mm.; rostrum, from orbital angle to tip, 2 mm. Carapace produced to a wide median triangulation between the orbits and this is extended distally as a laterally compressed sword-like blade, which has its posterior origin in a rostral carina that arises at a point in line with the median posterior orbital margin and extends distally about 1 mm. beyond the tip of the peduncle of the antennulae, or as far as the distal margin of the first thick ring of the flagellum; the rostrum extends as far midway or a little more than midway the scaphocerite; on the dorsal edge the rostrum is serrated by four or five pointed teeth, in addition to the acute apex. The proximal tooth is about in line with the posterior margin of



Coralliocaris superba (Dana), $\times 6$.

the cornea; the second tooth about midway the cornea; the third tooth slightly beyond the distal margin of the cornea; the fourth tooth midway between the third tooth and the apex. The first three teeth are almost subequally spaced, the fourth tooth being slightly closer to third, also to the apex, than the other teeth are to one another. On the ventral margin this rostrum is convex toward the distal end and serrated by two rather close-set teeth, one each approximately opposite the upper distal two teeth. There is a very slight carina on the lateral surface of the rostrum which posteriorly is continuous with the lateral margin of the widened triangulate area of the rostrum and beyond this with the orbital margin, which on its outer half becomes depressed in relation to the wide, crescentic concavity that exists here on the dorsal surface of the carapace behind the outer half of the orbit, and thence forward along the frontal margin and adjacent carapace to the antennal spine, which is strong, acute, not quite attaining the frontal margin but outward and forward-directed with the apex extending beyond the frontal margin, also with a much smaller, similar shorter spine behind and outside of this. Outside of these two spines the frontal margin of the carapace is evenly rounded, the extreme anterolateral margin being rounded and closely appressed to the carapace. The abdomen is 6 millimeters long and appears dwarfed in comparison with the stout carapace. The abdomen is closely compressed laterally and tapered posteriorly, the first, second and third segments being much wider and stouter than the fourth, fifth and sixth segments; the third segment is much prolonged and rounded posteriorly in the median region; the fourth segment is quite short; the fifth segment intermediate in length between the fourth and sixth segments; the latter is two-thirds as long as the telson, which is very narrowed, dorsally rounded, tapered distally, truncate, with but very little convexity and setose; the dorsal surface bears two pairs of articulate spines, one spine of each pair, on each lateral margin of the distal half of the telson. The uropoda have the peduncle short, distally bifurcate; the blades are about one-fourth longer than the telson, narrowly, regularly ovate, the distal margins finely crenulate and ciliate; the outer blade is the wider and bears a subdistal spine on the outer lateral margin.

The eyes are large, set upon a stout stalk.

The antennulae have the basal article thin, laminate, with an

acute tooth distally; the first article is about half as long as the rostrum; the second and third articles short, successively narrowed; the upper thick branch of the flagellum, with the first ring, so large that it could easily be mistaken for the last peduncular article, especially since the first peduncular article is almost concealed dorsally; this whip tapers considerably distally and is about one or two rings longer than the scaphocerite; the second whip is one and one-half times as long as the first and much slenderer.

The antennae have the basal article rather thick and broad, dorsally a little rounded and terminating at the outer distal angle in a tooth which is in line with the antennal tooth; the scaphocerite is quite large, extending as far forward as midway the carpus of the extended great cheliped and is nearly straight on the outer lateral margin, slightly flared outward near the acute, subdistal tooth; the inner lateral margin is constricted proximally, rather widely rounded for the greater part of its length, tapered a little distally, the distal margin evenly rounded, crenulate and ciliate. The second and third articles are thick, cylindrical, together not quite half of the length of the scaphocerite; the flagellum is composed of longish, coarse rings and is nearly twice the length of the scaphocerite.

The external maxillipeds are very slender, with the predistal and distal articles of the endognath quite slender; the exognath is as wide as the predistal article of the endognath and extends to midway the distal article, and is tipped with spinose bristles.

The first pair of chelipeds are slender, stick-like, each reflexed upon itself from the meral-carpal joint; the ischium is half as long as the merus and somewhat laminate, being about twice as wide as the merus, which is very narrow, cylindrical, reaching as far forward as the antennal peduncle, but of distinctly less diameter; the reflexed carpus is as long as the merus, but slenderer; the propodus, dactyl included, is two-thirds as long as the carpus, slenderer; the very weak subequal dactyli, each being one-third of the total propodal length, the tips fuzzy with outstanding short setae. When extended, the first pair of legs reach to about one-third of the length of the palm of the great cheliped.

The second pair of chelipeds, when extended, is nearly as long as the entire body of the shrimp. The basis and ischium are each short, but successively widened distally; the merus is enlarged, extending as far forward as the tip of the scaphocerite,

with the under surface wide, flat, with an irregular, laminate angulation at its inferior subdistal angle; both lateral surfaces of the merus are narrowed, each being less than the one-third of the width of the lower surface; the upper surface is similar to the lower, except that it lacks a distal angulation; the carpus is small, obconic, hinge-like, sharply excavated on the inner lateral surface and with the distal margin concavely excavate; the palm is 6 millimeters long, including the fingers, the fingers being one-third of this length. The palm is dilated and dorsally convex for the proximal three-fifths, attaining its greatest width, which is one-third of the length, at this point, beyond which the distal two-fifths of the palm, fingers not included, is somewhat compressed laterally, this becoming more decided toward the area adjacent to the base of the fixed finger. This fixed finger is dorsal in position, one-third of the length of the palm, or one-fourth of the total propodal-dactylar length, and is slender, tapered, much compressed laterally, with a decidedly curved, acuminate tip, overlapping that of the opposed finger; the cutting edge is proximally bidentate, distally laminate on the inner surface, and this is paralleled on the outer side by a distinct, narrow, concave trough, or groove, which is deepest near the tip. Several long, solitary setae are present within this groove; also both fingers have numerous long, solitary setae fringing both the upper and lower outer lateral margins. The hinged finger, which is curiously ventral in position, has a decidedly curved, acuminate tip. This finger is approximately as strong, wide and deep as the lower finger. The hinged finger is wider proximally, transversely depressed at the base, thence angulato-sinuate in dorsal profile, also in lateral profile; viewed dorsally the proximal two-fifths is somewhat compressed laterally, with a decided blunt node two-fifths of the length from base, accentuating the point at which the distal three-fifths of the finger abruptly curves inward; this distal portion is widened, low, rounded dorsally, its outer lateral margin quite convex, subcarinate, the inner lateral margin less convex, both converging distally toward a medial rounded node above the base of the down-curved, laterally compressed, medially carinate, acuminate tip, which fits into and overlaps slightly beyond the concavity of the fixed finger; the cutting edge of the fixed finger is produced into a thin lamina which forms a triangulate tooth proximally that fits in between the two similar teeth of the lower finger.

The third, fourth and fifth pairs of legs are similar, successively moderately shorter in the order named; each has the merus the longest article, and widest, with the outer lateral margin convex; the carpus is slenderer, two-fifths as long as the merus, with a very sharp tooth at the outer distal angle; the propodus is two-thirds as long as the merus, subcylindrical, moderately thick, but less so than the merus; the dactyl is very short, one-third of the length of the propodus, with the ventral surface ovate-laminate, with the extreme distal border reinforced by a thick calcium rim, while the upper lateral surfaces are a rounded, convex area that is produced into a remarkable, upstanding, curved, hook-like spine, with the very curved, slender apex down-bent. At the base of this dactyl the outer distal surface of the propodus supports a cluster of solitary bristles that project over and above this dactylar dorsal spine.

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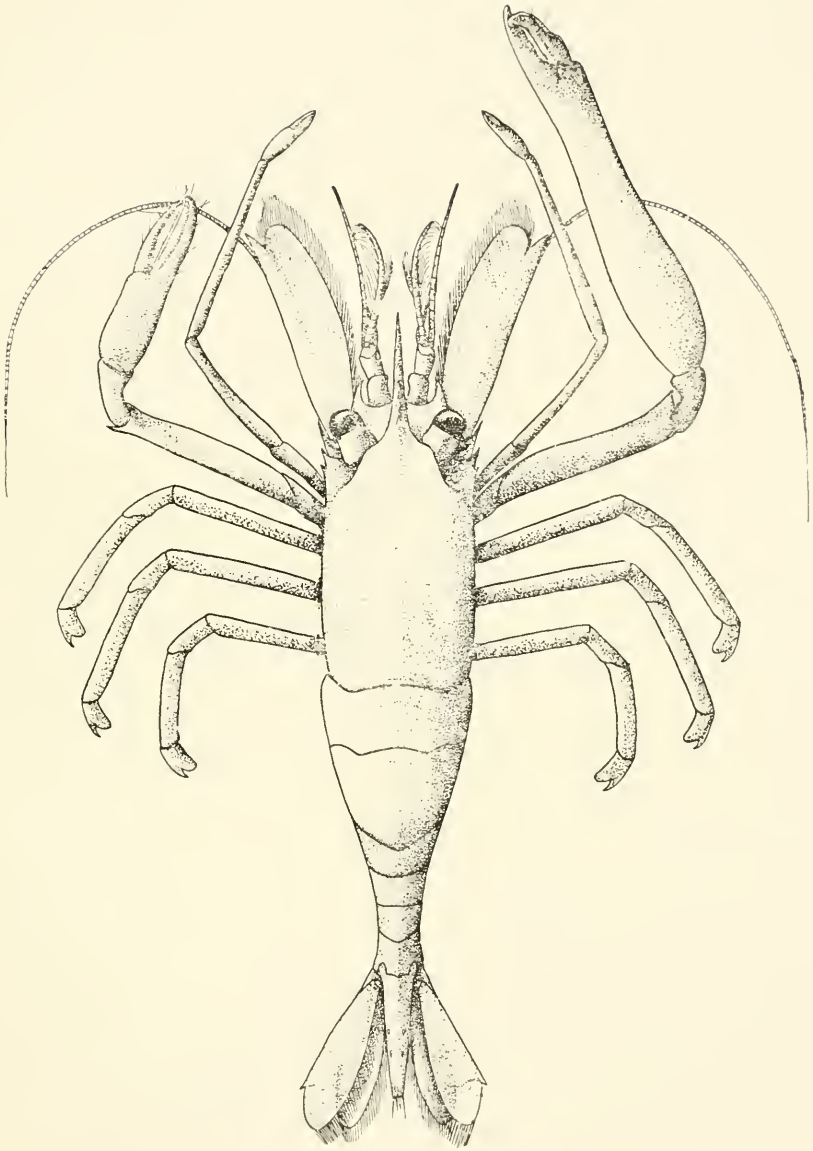
Oedipus dentirostris, PAULSON, O., Crust. Red Sea, vol. I, 1875, p. 112, pl. 14, fig. 7.

Coralliocaris lamellirostris Stimpson

Plate 47

TYPE: Mr. Stimpson's type was collected in Loo Choo Islands and was deposited in the Smithsonian Institute, but is no longer extant.

DISTRIBUTION: This *Coralliocaris* is usually found in association with Madrepore corals. It has been recorded from Loo Choo Islands (Stimpson); Red Sea, numerous stations (Nobili, Balss,



Coralliocaris lamellirostris Stimpson, $\times 4$.

Tattersall); south coast of Arabia (Balss); Maldives, Chagos Archipelago, Saya de Mahla (Borradaile); Andaman Islands, several localities (Kemp); Cheval Paar, Ceylon (Southwell, Kemp); Tahiti (Boone).

MATERIAL EXAMINED: Two specimens, Venus Point Reef, Tahiti, Society Islands, August 15, 1931.

TECHNICAL DESCRIPTION: This species is represented in the collection by specimens taken in close proximity to *Coralliocaris superba* Dana, from which it is readily distinguished by the following:

The carapace is slenderer, and has the hepatic spine present, usually very strong.

The external maxilliped is much slenderer, having the exognath very slender and extending as far as the distal border of the penultimate segment of the endognath; the latter has the first joint slender with a small proximal rounded expansion; the length of this article is about four times the average width; the second joint is about one-half as long as the first, slenderer, about two and a half times as long as wide; the distal article is tapered, about one-sixth longer than the preceding article; all three joints are setigerous on the inner lateral margin.

The first pair of legs is very slender, with the carpus from one and three-fourths to two and one-half times as long as the related chela; the palm is twice as long as the fingers. The second pair of legs is unequal and of different structure. The merus of each is slender, devoid of an upper distal tooth, but with a strong distal tooth present at the inferodistal margin; the carpus has the upper distal margin entire and bears no ventral tooth. In the large chela, which may be either the right or left one, the palm is slender, convex, narrowed distally, from three and one-half to four times as long as the fingers; the dactyl is dorsally carinate and abruptly angulated midway this margin, the angulation ending in a rounded node; the finger tip is curved, acuminate; the cutting edge carries two or three small teeth near the center, which interfit with two opposed teeth of the lower finger. This chela opens almost vertically. The smaller chela has the palm moderately slender, with the fingers about two-thirds as long as the palm with the cutting edges laminate, with a distinct concavity of the two fingers, and tips both curved, so that from

the outer side the chela appears spoon-shaped. Several solitary setae border the laminae of the cutting edges.

The telson of the present specimens have respectively six, nine and sixteen distal marginal spines. Dr. de Man has reported specimens having sixteen to eighteen telsonic spines and Dr. Kemp had one with nine spines.

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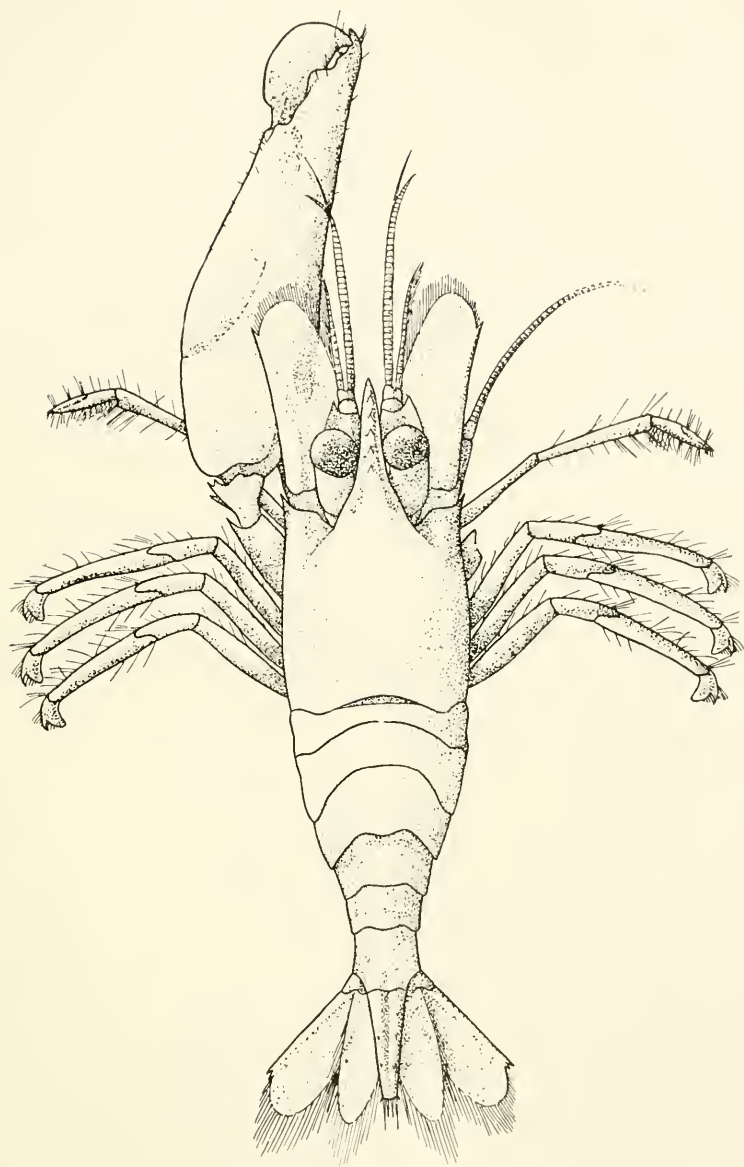
Coralliocaris superba var. *japonica*, BORRADAILE, op. cit., p. 384.

Coralliocaris graminea (Dana)

Plate 48

TYPE: Dana's type came from the "Pacific, on the coral reef, among growing corals, at Rewa, Viti Lebu, Fiji Archipelago," and is deposited in the Philadelphia Academy of Natural Sciences.

DISTRIBUTION: This species, which usually lives in association with Madrepore corals, is a widely distributed member of the coral reef fauna. It is known from the Red Sea eastward in India, Japan, Java, New Caledonia and the Fiji Islands; also on the east African coast, southward to Mozambique. It has been recorded from the following places: Red Sea, ten localities (Balss); Pamban, Gulf of Manaar, Port Blair, Andamans (Kemp); Hong Kong (Stimpson); Kagoshima, Japan (Ortmann); Johnston Island, Wake Island, Palmyra Island (Edmondson); Ternate, Pulo Edam Island, Bay of Batavia (de Man); South Seas, New Caledonia, Pulo Condore (Kemp); Christmas Island (Calman); Sandal Bay, Lifu, Loyalty Isles (Borradaile); Falcon Island, Queensland (Boone); Coetivy (Borradaile); Seychelles (Kemp,



Coralliocaris graminca (Dana). $\times 4.5$

Miers) ; Zanzibar (Pfeffer) ; Dar-es-Salaam (Ortmann) ; Mozambique (Lenz).

MATERIAL EXAMINED: One specimen, taken in coral, Falcon Island, Palm Islands, Queensland, October 7, 1931.

TECHNICAL DESCRIPTION: Carapace typically stout and nine-tenths as broad as long, depressed; length from orbital angle to posterior margin, 5 mm.; width, 4.5 mm.; rostrum, 3.8 mm. long from tip to orbital angle, or almost three-fourths as long as the carapace. The rostrum arises as a wide triangle between the eyes, which narrows rather abruptly just anterior to the eyestalk and proceeds from this point forward as a slender, acuminate triangle, the apical third of which is quite stylus-like and which is dorsally carinate, this sharp carina continuing posteriorly the entire length of the rostrum, terminating abruptly in a rounded end proximally on the base of the rostrum, with a small depression on either side of the rostrum at the base; this rostrum is directed straight forward for the proximal two-thirds of its length, thence slightly downward; there are five acute, subequal, forward-directed teeth in serial arrangement on the carinate dorsal rostral margin, the proximal tooth being above and slightly in advance of the proximal margin of the scaphocerite, and the fifth, or distal, tooth being subdistal to the acuminate apex; there is but one acuminate tooth on the inferior rostral margin and this is opposite the subdistal fifth tooth of the upper margin. The rostrum extends beyond the antennular peduncle by about three rings of the related flagellum, or is equal to two-thirds of the length of the scaphocerite. There is no supraorbital spine present, but the usual pronounced depression of carapace behind the lower side of the orbit.

The abdominal terga are generically characteristic; the third segment is about two and one-third times the length of the second segment, has the median region produced posteriorly and the posterior median margin rounded; the fourth segment is about two-thirds as long as the third segment; the fifth segment is nearly as long as the fourth; the sixth segment is about one and one-half times as long as the fifth; the telson is one and three-fourths times as long as the preceding segment, very narrowed, triangulate, and dorsally carinate, with four pairs of articulated spines, in submedian, longitudinal series; the apex of the distal margin has an acute tip, flanked by a pair of long, articulate spines, which project beyond the telson. The uropoda are about one-fourth longer than

the telson, of moderate size, the blade unequal, subovate, the outer one being the wider and having a sinuate transverse suture distally and a conspicuous subdistal tooth on the outer lateral margin.

The eyes are characteristically large, stalk proximally constricted, the distal half bulbous; the cornea large, terminal, nearly hemispherical; when directed forward, the eyes extend two-thirds of the rostral length.

The antennulae have the first peduncular article two-thirds as long as the rostrum, laminate, dorsally concave, the inner lateral margin slightly convex, outer lateral margin narrowed proximally, the outer side deeply, obliquely incised, forming a strong, triangular process, the acuminate apex of which extends beyond the margin; the outer distal angle is also produced into a triangular tooth of different proportions that extends to about the distal margin of the third peduncular article; the second and third articles are small, cylindrical, slightly unequal in length; the flagellum has the outer, longer branch extending beyond the scaphocerite for about half of its length; the inner branch is not quite so long as the scaphocerite.

The antennae have the basicerite strong, wide, extending forward to midway the proximal, lateral spine of the first peduncular article of the antennulae; the basicerite has an acute out- and forward-directed spine at the outer distal angle; the scaphocerite extends to about two-fifths of the length of the great cheliped and is moderately, regularly convex on the inner lateral margin; the outer lateral margin is nearly straight proximally, moderately concave distally, terminating in an acute tooth subdistal to the somewhat obliquely truncated, yet slightly rounded, distal margin; the inner lateral and distal margins are fringed with web-like multiplumose setae.

The first pair of legs is very weak, chelate, when extended, the tip of the chelae reaching two-fifths of the length of the palm of the great cheliped; these first legs are slenderer throughout their length and only a little longer than the first pair of ambulatories, with the carpus, propodus and dactyl furnished with numerous outstanding, hook-like setae.

The second pair of chelipeds unfortunately has the right leg missing. The left leg, which is apparently the larger one, is 15 mm. long, or approximately equal to the total length of the body, rostrum included, has the merus very slender, trigonal, with an

acute spine at the inferior outer distal angle; the carpus short, cup-like, distally concave with a bidentate process at the upper, outer distal angle; the palm, which is 11 mm. long, or a little over twice as long as the carapace, the fingers being one-third of this total length, 3.8 mm. long, lies so that the chela opens horizontally, with the hinged, upper finger lying on the outer side, instead of the usual upper position. The palm, which is convex proximally and which is substantially dilated for the proximal two-thirds of the length, is subcylindrical, being one-half as high in the greatest height as long, and approximately two-thirds as thick as high, tapers distally towards the base of the finger, where it terminates in a blunt, low node on the upper outer side, this upper outer margin appearing in profile, to terminate in a small denticle. The lower finger, which is laterally compressed, bears proximally a large, obliquely placed, rounded molar that fits into an opposed, deep concavity of the upper finger; beyond this molar the lower finger is abruptly compressed, the cutting edge becoming a laminate convexity, the tip being upcurved, acuminate, overlapping that of the upper finger. The inner, or upper side of this outer laminate cutting edge is paralleled by a linear but definite channel. There is on the inner (exposed as upper) surface a curved, shallow suture line that proximally appears about two-fifths of the length of palm from base, curves down on the inner surface to extend more than half the depth of the palm and thence up and forward, vanishing on the anterior margin of the palm above base of fingers. This suture is continuous thence on the outer (lower) surface of the palm, which is less arched, extending only the upper third of the depth of the palm and completing an elliptical outline. All surfaces of the cheliped and ambulatories are furnished with numerous solitary hooked setae. The upper finger is sublunate in outline, with the upper margin very convex, the cutting edge proximally with a deep concavity and beyond this sinuate, terminating in an acute tip that overlaps on the upper side of the lower finger.

The ambulatories are moderately stout, successively decreasing in length in the order 1, 2, 3, but subsimilar, with the merus, carpus and propodus subcylindrical, laterally compressed; the dactyl short, blunt, with substantial thickened base which is subtriangulate and corrugate on the basal (ventral) surface, the apex blunt; with the upper surface rounded, thickened and sup-

porting dorsally a strong, curved hook-like spine; there are no accessory spines present on either propodus or dactyl, but there are a series of cuff-like bristles on the distal end of the propodus.

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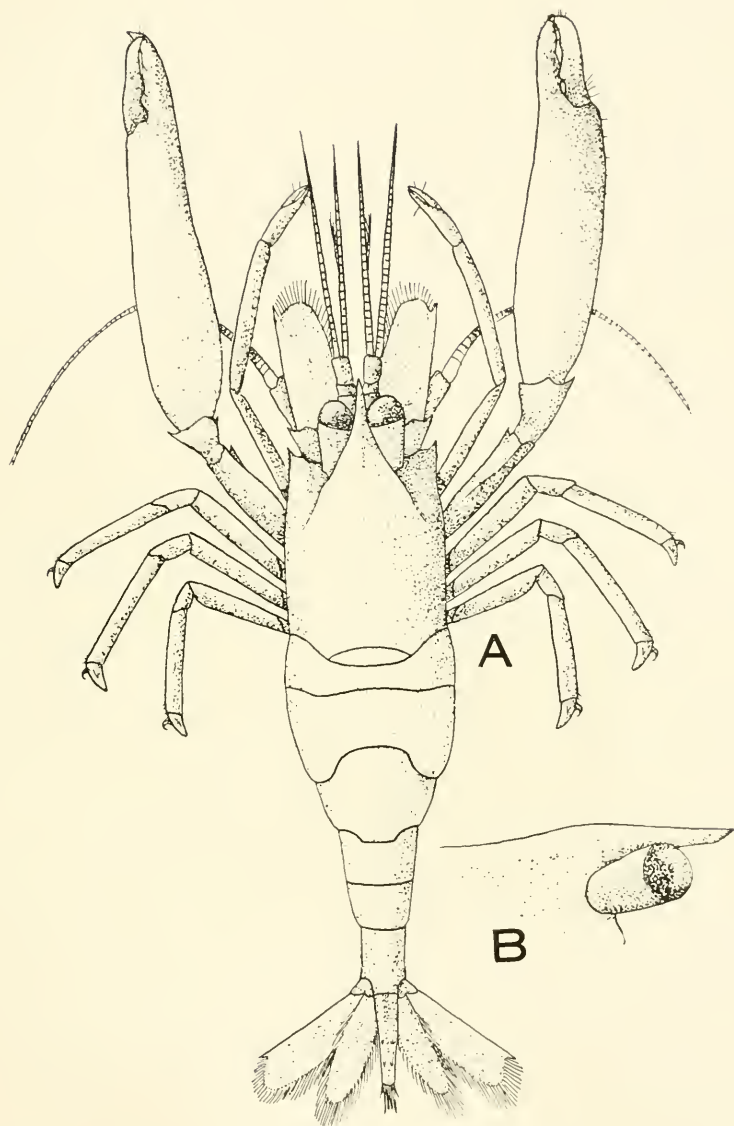
Coralliocaris tahitoei, new species

Plate 49

TYPE: One specimen, taken at Venus Point Reef, Tahiti, Society Islands, August 15, 1931, by the "Alva," and deposited in the Vanderbilt Marine Museum.

COLOUR: Unrecorded.

TECHNICAL DESCRIPTION: The type is about 12 mm. long, with the telson somewhat broken. The carapace is broad, 3 mm. median width, 5 mm. long from tip of rostrum to posterior margin, flattish on the median area, rounded towards the sides; the



A, *Coralliocaris tahitoei*, new species, type, $\times 6$;
B, profile, showing rostrum, greatly enlarged.

frontal portion is produced to a very broad, median triangulation that tapers distally between the orbits into a laterally compressed, non-dentate, distally acute rostrum, which extends as far forward as the distal margin of the second peduncular article of the antennule. Proximally the rostrum is defined on either side by a deep sulcus that extends as far back as does the rostrum, approximately at a point opposite the base of the eyestalk; there is no supra-orbital spine, but the lateral margin of the rostral triangle, outside of the rostral sulcus is bent obliquely upward, forming the inner lateral orbital margin. There is a decisive concavity of the hinder orbital margin and outside of this a wide sublunate depression on the carapace. The infraorbital tooth is blunt, nearly right-angled, closely appressed, and has running from the apex on the outer side a carina. Beyond this there is a strong antennal spine, which is continued posteriorly as a strong carina, ridge-like, defining the outer lateral margin of the suborbital concavity. Below this carina the lateral wall is convex, closely appressed to the body, the anterolateral angle acute, but scarcely spinose. The abdominal terga are smooth, the first and second segments quite wide, the third and fourth segments abruptly narrower; the remaining segments somewhat broken, but having the pattern shown in Plate 49.

The eye has a thick cylindrical stalk, two-thirds as wide as long, shorter than the rostrum; the cornea is large, terminal, hemispherical, extending not so far as the rostrum by about 1.5 millimeters.

The antennulae have the peduncle only half so long as the scaphocerite, or exceeding the rostrum by the length of the distal article; the outer flagellum is substantially the thicker for the proximal six rings, which extend to the tip of the scaphocerite, and beyond this there are eighteen to twenty smaller, slenderer rings, extending beyond the scaphocerite for a distance equal to three-fifths of the length. The inner, slenderer branch is almost as long as the outer one.

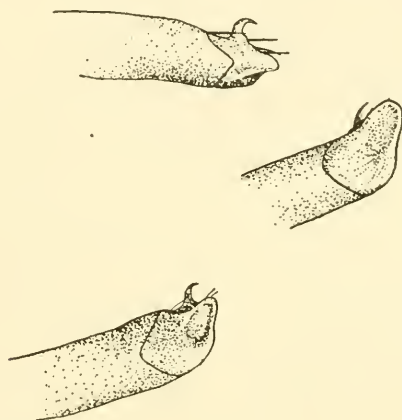
The antennae have the basal article short and wide with an acute spine at the outer distal angle, this spine being in line with the antennal spine; the scaphocerite is twice as long as the antennular peduncle, subovate, with the outer lateral margin nearly straight, terminating in a very acute, subdistal spine, the distal margin is quite broadly and somewhat unevenly rounded, crenu-

late and ciliated, the inner margin evenly convex; the greatest width of the scaphocerite is across the median area; the second and third peduncular articles are subcylindrical and together extend the length of the scaphocerite; the flagellum, which is quite slender, extends almost to the base of the dactyli of the great cheliped.

The first chelipeds are very slender, subequal, reflexed upon themselves; with the ischium strong, one-third as long as the merus, with the outer distal angle acute; the merus and carpus are elongate, slender, subequal, the merus is slightly longer than the antennal peduncle; the propodus, finger included, is about half as long as the carpus, the fingers being about as long as the palm and very tapered, meeting throughout their lengths.

The second chelipeds open vertically with the thumb above and are large, subequal, when fully extended, projecting beyond the body for a distance equal to or slightly greater than the total body length. The merus is trigonal, 3 mm. long, projecting substantially beyond the scaphocerite and having an acute, triangular tooth at the inferior inner (but reversed to appear outer) distal angle. The carpus is short, 1 mm. long, bent, distally expanded, laminate, concave, with an acute triangulation at the inner lower distal angle. The propodus is 7 mm. long, the fingers being 2 mm. of this length, or definitely less than one-third of the total propodal length. The palm of the present specimen is *Alpheid*-like, moderately dilated proximally, narrowed but substantially convex distally, although somewhat laterally compressed here; the longer dactyl is substantial, laterally compressed, with a strong upcurved apex, which overlaps on the inner side of the downcurved apex of the upper dactyl. The cutting edge of the lower dactyl has two broad, triangulate teeth, one on either side of the similar tooth of the upper finger. There are two distinct tufts of long setae, one on the outer lateral, one on the inner lateral margin, but subdistal to the tip. The upper dactyl is sinuate, the contour, viewed dorsally, showing a concave bend on the outer lateral margin and the acute tip down-curved. The cutting edge has one acute, strong, triangulate tooth, placed subproximally and interfitting between two wide, triangulate teeth of the lower finger. The distal half of the cutting edges of both fingers are laminate, meeting, except at the over-crossed, acuminate tips.

The third, fourth and fifth pairs of ambulatory legs are successively moderately shorter in the order named; each has the basis and ischium short, substantial; the merus elongate, about three times as long as the related ischium; the merus is about two-fifths as wide as long, dorsoventrally compressed; the carpus is one-half as long as the merus, more cylindrical; the propodus is similar to the carpus but is subequal in length to the merus; the dactyl is very short, its greatest length about one-sixth of that



Text figure 12—*Coralliocaris tahitoei*, new species, three views of dactyl of third leg: upper, lateral profile, middle, ventral view, lower view, three-quarters profile; all greatly enlarged.

of the propodus and with the two lateral margins converging to form a thickish triangulate tip, which is slightly incurved; on the upper outer flattish surface of this triangle there is a very strong upstanding, procurved, acuminate hook, the tip of which is bent downward. Viewed ventrally this triangle is a blunted, thickened ridge. There are no other supplementary spinules on the dactyl. Likewise, there are no articulated spines present on the inferior lateral margin of the propodus of the present species; the ambulatory legs being typically *Coralliocaris*. (See text, fig. 12).

The external maxillipeds are very slender. The exognath is tapered, slender, setose, and extends almost to the distal margin of the second article of the endognath. The first joint of the endognath is slightly longer than the related two succeeding joints and is nearly four times as long as its median width; the second

joint is very slender, about four times as long as wide; the distal article is subequal in length to the preceding article, but narrower, tapered, being about five times as long as wide.

I have associated the name of Chief Tahitoe, of Raiatea Island, with this species.

The present species is readily distinguished from its congeners by the smooth, non-dentate rostrum, in the distinctive slenderness of the third maxilliped, and in the length ratio of fingers to palm in the second pair of chelipeds, as well as their form and dentition.

Conchodytes Peters

Conchodytes biunguiculatus (Paulson)

Plate 50

TYPE: Paulson's type was collected in the Red Sea and is deposited in the Kiew Museum.

DISTRIBUTION: Red Sea (Paulson; Nobili); Port Blair, Andamans, in *Pinna bicolor*, Gmelin (Kemp); Gulf of Manaar (Pearson). In *Meleagrina* species, Suva, Vitu Levu, Fiji Islands, September 9, 1931 (Boone).

As pointed out by Dr. Kemp, September, 1922, the Red Sea stations of Dr. Nobili,¹ and those of Mr. Pearson,² in the Gulf of Manaar, listed as *Conchodytes*³ *meleagrina* Peters, in *Pinna* species, are probably *C. biunguiculatus* (Paulson). The "Alva" specimens from Fiji are the first record of this species in pearl oyster. However, the notation "pearl oyster" was made by a layman.

MATERIAL EXAMINED: Four ovigerous females and three males found inside of pearl oyster, *Meleagrina* species, Suva, Vitu Levu, Fiji Islands, September 9, 1931.

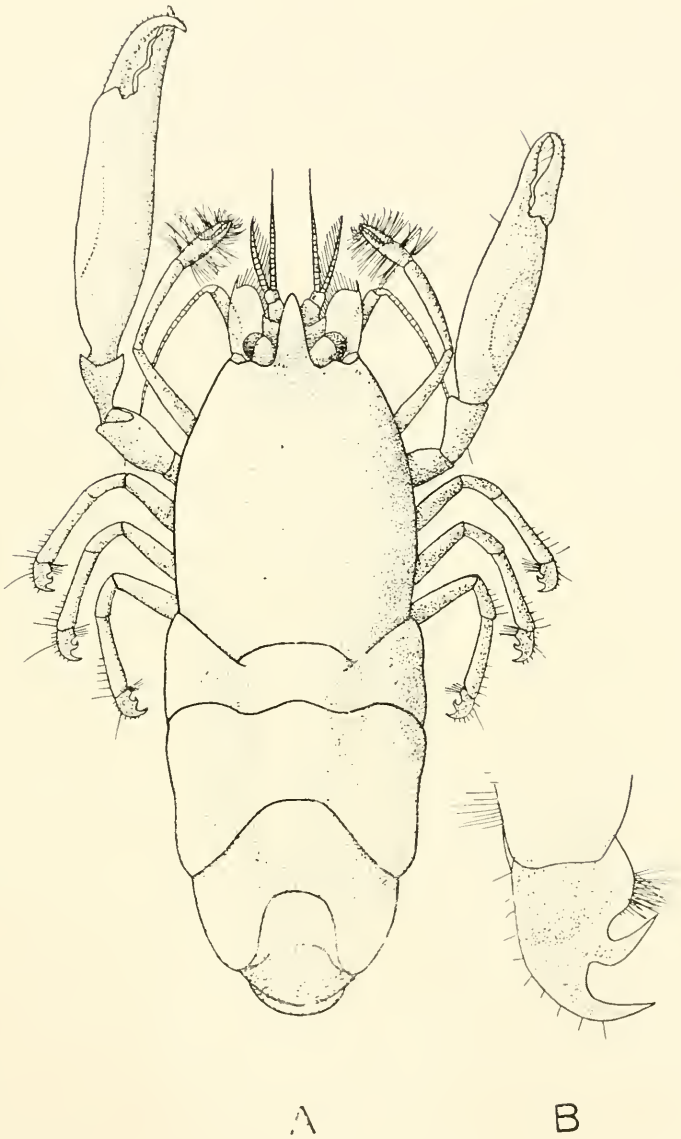
TECHNICAL DESCRIPTION: Body stout, rather broadly swollen, depressed, especially so in the females, which in the small series taken are approximately one-third larger than the associated males. The female herein described is 22.5 mm. long, the rostrum being 2.5 mm., the carapace 6 mm. and abdomen 14 mm. long, respectively.

Rostrum short, sharply compressed laterally, downward curved, apex subacuminate, ventral margin keeled; rostrum 2.5

¹NOBILI, G., Acc. Sci. Nat. Zool. Paris, ser. 9, t. IV, 1903, p. 66.

²PEARSON, J., Rept. Ceylon Pearl Oyster Fish. and Marine Biol., pt. 4, 1905, p. 77.

³*Conchodytes meleagrina*, PETERS, F., Berichte d. k. Preuss. Akad. d. Wiss. Berlin, 1852, p. 594.



Conchodytes biunguiculatus (Paulson), A, dorsal view, $\times 4$;
B, dactyl of third leg, profile, greatly enlarged.

mm. long, extending only to midway or about three-fifths the length of the second peduncular article of the antennulae. The eyes are conspicuous, apparently normally directed obliquely outward and forward, their length about one-fifth less than that of the rostrum; stalk thick, short, width almost equal to their length; cornea hemispherical, terminal, its depth about one-third less than the visible portion of the stalk.

Antennulae with the first peduncular article oblong, laminate, a little shorter than the rostrum, with an acute, small tooth at the outer distal angle; the second and third articles, cylindrical, subequal, length no greater than width, flagellum short, inner whip about as long as the peduncle, consisting of approximately ten longish articles, the proximal five of which are thickish; the outer whip two-thirds as long as the inner whip, fleshy, subclavate, consisting of about eight closely fused rings, the inferior lateral margin with a web-like fringe of long setae.

Antennae with the basicerite short, scaphocerite a little longer than the antennular peduncle but about 1 millimeter shorter than the antennal peduncle, quite widely oval, the greatest width being equal to two-thirds of the length; the inner lateral and distal margins being much more convex than the slightly bowed outer lateral margin, which terminates in an acute, incurved distal spine that projects beyond the convex distal margin and extends as far as does the distal margin of the third peduncular article; the second peduncular article is short, cylindrical; the third article similar, but very long and slender, reaching a little beyond the distal, convex margin of the scaphocerite; the flagellum is about one and a third times as long as the peduncle and quite slender.

The first pair of chelipeds is equal, slightly slenderer than any other pair, approximately equal in length to the first pair of ambulatories; the ischial joint is two-thirds as long as the merus; the merus is compressed cylindrical, subequal in length to the carpus, which is more slender, clavate, very narrowed proximally, widening distally; the propodus is three-fifths as long as the carpus, of no greater width, the palm is cylindrical, a little longer than nearly subequal fingers, which are tapered, meeting throughout their length, pointed distally.

The second chelipeds are moderately enlarged, with the ischial, meral and carpal joints of subequal length; the ischial joint slender, sublamineate, arched; the meral joint thickened, unequally

trigonal, the inner lateral face much smaller than the other two, which are rather convex; the carpus is subconical, widening distally with the upper outer distal margin excavate; the propodus is about three and one-half times the length of the carpus, with the palm much dilated, about two-thirds of the total propodal length; most dilated proximally, the greatest height being 0.4 of the length, the least height 0.3 of the length; the fingers are both decidedly deflected, the upper one being the more down-curved; the lower finger down-curved and also incurved, the tips conspicuously overlapping; the cutting edge of the lower finger is sinuate, with a small basal molar, followed by a wide concavity, into which the very large, median molar of the upper finger fits, and beyond this concavity is the large, wide, triangulate tooth, the outer margin of which slopes toward the acuminate tip of the finger. The above mentioned median, acuminate-triangulate molar of the upper finger is the only tooth it has, the remainder of the margin being sinuate-laminate.

The ambulatories are moderately stout, subcylindrical. The first pair of ambulatories measure as follows: ischium, 2 mm. long; merus, 2.5 mm.; carpus 1.8 mm.; propodus, 2.8 mm.; dactyl, 0.19 mm. long; the upper dactyl margin is very curved, terminating in an acute hook, the lower lateral margin is concave, with a median, curved hook, which is subequal to the upper distal hook; beyond the median hook the inferior angle is a blunt node which supports a tuft of coarse bristles. On the third pair of legs this basal node is relatively larger than on the two preceding pairs of legs.

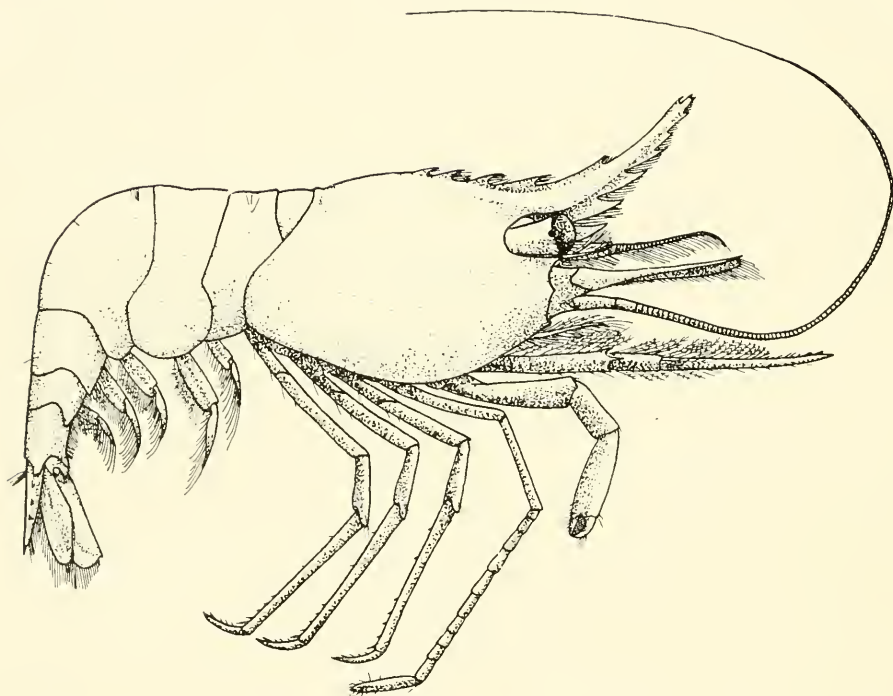
The abdominal terga are especially broad in the female, with the epimeral region deep, forming a capacious brood pouch, which holds seventy-five to a hundred young.

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Conchodytes biunguiculatus, KEMP, S., Rec. Indian Mus., vol. XXIV, 1922, p. 280, text figs. 103a-d.



Saron marmoratus (Olivier), $\times 1.5$.

Family: **HIPPOLYTIDAE**

Genus: **SARON** Thallwitz

Saron marmoratus (Olivier)

Plate 51

TYPE: M. Olivier's type came from Oceania, probably New Holland, and is deposited in the Paris Museum.

DISTRIBUTION: This species has a wide distribution, being found in the Red Sea and along the eastern shores of Africa down to Natal; eastward from the Red Sea through the Persian Gulf, the shores of India and Ceylon, the Philippines, the Malay Archipelago, the Dutch East Indies, and many archipelagoes in Oceania, eastward to the Hawaiian Islands and the Paumotus. The following localities for it have been recorded: Red Sea (Heller, Nobili); Red Sea at 16 stations (Balss); Massaouah (Nobili); Upanga-Riff, Dar-es-Salaam, Zanzibar (Ortmann); Mozambique (Bianconi, Hilgendorf); Mauritius (Kemp); Arabian coast, Gulf of Persia, Station 25 (Nobili); Kubber Island Reef, Persian Gulf (Kemp); India: Port Canning, Ganges Delta; Kilakara, Pamban, also Ramnad District; South India, coral reef; Karachi, mouth of the River Indus, Andaman Islands (Kemp); Ceylon (Pearson); Cebu, P. I. (Thallwitz); Amboina (Zehntner); Ternate, Pulo Edam Island and Nordwachter Island (de Man); Bali (Boone); Malay Archipelago (Dana, Heller, de Man, Borradaile); Queensland, Australia (Kemp); Falcon Island, Queensland (Boone); Australia (Haswell, H. M. Edwards); Nivani, Louisades, British New Guinea, Funafuti (Borradaile); Funafuti Atoll, Ellice Islands (Whitelegge); New Holland (H. M. Edwards); along the shores of Vitu Lebu, Fiji Islands; Sandwich Islands (Dana); Hawaiian Islands, Randall, "very common" (Edmondson); Palmyra Island, French Frigate Shoals, Johnston Island and Wake Island (Edmondson); Rikitea (Nobili); Marquesas Islands (Boone).

MATERIAL EXAMINED: One ovigerous female and one larger female taken in coral reef at Anaho Bay, Nuka Hiva Island, Marquesas Islands, August 10, 1931. One specimen from coral at Falcon Island, Palm Islands, Queensland, October 7, 1931. One ovigerous female taken from coral, Temukus Roads, Bali, Dutch East Indies, October 25, 1931. One very young specimen also from Temukus Roads, October 25, 1931.

TECHNICAL DESCRIPTION: The larger of the Anaho Bay, Marquesas Islands, specimens is the one herein described. The carapace is short, compact, 10 mm. long from the orbital angle to posterior margin, 10 mm. median height in profile, moderately convex on either side of the median dorsal line, which is elevated from a little in front of the flatly carinated posterior margin toward the center for the proximal two-fifths of the carapace, from which point forward it becomes a carinate, denticulate crest bearing three increasingly larger, acute, triangulate, forward-directed teeth on the carapace behind the orbital angle, beyond which point the large, laminate-dentate rostrum extends forward, curving downward moderately and thence the apical two-thirds is curved upward, the distal third exceeding in height the highest point of the posterior rostral crest. The fourth rostral tooth is the largest of the series and occurs above the eye; the fifth tooth is well in advance of the fourth, much smaller, less crest-like, being situated approximately at the point where the upcurving of the distal rostrum begins and also marking the anterior termination of the rostral upper lateral carina, which vanishes posteriorly just behind the orbital angle. The distal upper portion of the margin of the rostrum is without teeth, subcarinate, the upturned distal end truncate, tridentate; these teeth acute, triangulate, slightly increasing in size from upper to lower and with tufts of bristly setae between the teeth. There is a median lateral thickish carina proximally above the orbit, on either side of the rostrum. The lower portion of the rostrum is produced into a deep convex lamina proximally, this lamina narrowing on the distal half; the deep convex portion is deeply incised into four unequal teeth, the second of which is unequally bifid, while the narrow lamina of the distal portion of the rostrum bears two more teeth; the teeth of the ventral series decrease in size toward the distal end of the rostrum, the sixth, or subdistal, tooth being subequal to the distal upper tooth. The spaces between the teeth on the inferior rostral margin are heavily fringed with coarse setae. There is a slender, acute, suborbital tooth present which projects almost to the base of the scaphocerite. The antennal angle has a small spine and the anterolateral spine is subacute.

The abdominal terga are rather compact, the first three broad dorsally; the third segment is the longest of the series in the median line, being produced and rounded posteriorly in this

region; the fourth segment is only four-sevenths as long in the median line as the third; the fifth segment is only three-fifths as long as the fourth; the sixth segment is only one and three-fifths times as long as the preceding segment, truncate above the base of the telson and produced in a longish, acute triangulation on either side above the outer angle of the telson. The telson is one and one-half times as long as the sixth segment; the dorsal surface is rounded with a slight median depression proximally, semi-concealed beneath tufts of setae; there are two pairs of coarse articulated spines present, the proximal pair being not quite half-way the length of the telson; the second pair being half-way between the first pair and the distal margin. The latter is narrowed, truncate and bears a pair of long submedian, articulate spines, and outside of these, one on each side, is another pair of minute articulate spines; the distal half of the lateral margin and the distal margin are heavily fringed with long, coarse setae. There is a strong, triangulate-articulate spine on either side at the outer proximal angle of the uropod peduncle, projecting upon it for half its length; the distal margin is unequally bifid; the blades are sub-ovate, each about one-sixth longer than the telson, the inner blade is the smaller, regularly ovate, the wider outer blade with a strong subdistal tooth at the outer lateral angle, from which a curved sulcus runs back to the base; the distal portion of the blade is separated by a sinuate suture; both blades are heavily setose on the distal half of their respective margins.

The eye is set on a short thick stalk which bears ventrally a strong, median spine on its distal margin; the cornea is deep, hemispherical, set obliquely terminal; there is a small circular ocellus on the dorsal surface of the stalk; the ventral half of the cornea is deeper than the dorsal half.

The antennulae have the basal article laminate, dorsally concave on the inner two-thirds with a very deep, narrow incision separating this from the outer distal angle, which is greatly produced in an acute, strong, outer spine that reaches as far as the distal border of the third peduncular article, and bears on its inner side another short spine, which is wider, triangular, and extends only about as far as the distal margin of the inner portion of this article; the second and third articles are short, thick; the third article bears distally on the dorsal surface a fleshy triangulate process that projects a short distance above the base of the

flagellum; the upper flagellum is very fleshy, dorsally wide and convex, for five-sixths of its length and with a continuous series of setae on the ventral surface; this branch is about as long as the rostrum. The lower flagellum is quite slender, very little longer than the upper one.

The antennae have the basicerite armed with an acute tooth at each the upper and lower outer distal angles, the lower spine being much the longer; the scaphocerite extends as far forward as the subdistal spine of the lower rostral margin. The scaphocerite has the outer side thickened, terminating in an acute distal tooth that projects beyond the truncate distal margin. This outer portion of the scaphocerite is separated from the inner portion by a curved longitudinal sulcus and there is additionally on the proximal median region a ridge which in turn has on its inner side another short sulcus; the inner side of the blade is no wider than the outer portion, except on the extreme proximal area, which has its outer margin moderately convex, the distal lateral margin being but little curved, while the distal margin is transversely truncated; the inner lateral and distal margins are fringed with setae; the remainder of the peduncle consists of three unequal articles, the distal of which is the longest; the peduncle extends little over one-third the length of the scaphocerite; the flagellum is about as long as the entire body and quite slender.

The external maxillipeds are pediform and exceed the length of the scaphocerite by the distal two-fifths of the terminal article, which is armed on its upper distal margin with a series of about seven strong, articulated, black spines in double series; the second article is only one-third as long as the third article; the first article is about four-fifths as long as the third article and has a tooth at its outer lateral distal angle; the second article and proximal part of the third article are beset with tufts of long, coarse setae.

The chelipeds of the present specimen are unequal, the larger one, extended, reaches only four-fifths the length of the scaphocerite and has the ischium slender, distally oblique, projecting on the inner face of the merus in an oblique point; the merus is regularly cylindrical, stouter and a little longer than the ischium; the carpus is similar to the merus but only three-fifths as long; the propodus is one and one-third times as long as the merus, the palm being cylindrical, two-thirds of this total length, the fingers curved with rounded, bidentate, black tips, which interfit, the cutting

edges of each finger deeply channelled, concavely, with the respective channels filled with bristly setae; the opposed fingers are separated, except at the tip, by a wide, elliptical sulcus. The smaller first cheliped only reaches to midway the palm of the larger cheliped and is of similar structure but has the finger-tips less dentate.

The second pair of legs is very slender, a trifle longer than the first pair, subequal to each other, and have the basis short, with a convex, laminate, setose process on the inner lateral margin; the ischium is slender, 5 mm. long; the merus, 2 mm.; the carpus, first joint, 3 mm.; second joint, 1.8 mm.; third joint, 0.8 mm.; the fourth, fifth, sixth, seventh and eighth joints each 1 mm. long; the ninth and tenth each 0.75 mm. long; the eleventh joint 1.5 mm. long; the palm is 2 mm., the fingers being 1.5 mm. of this, curved, meeting throughout their length, tips acuminate and fringed with a cuff of bristles.

The ambulatory legs are moderately strong, similar, decreasing a little in length in the order 1, 2, 3; the carpal joint has a strong, distally rounded protuberance on its upper distal margin; the propodus is almost as long as the related merus, armed on the distal half of the interior lateral margin with a longitudinal series, occasionally double series, of sharp black spines; the dactyl is two-fifths as long as the propodus, curved, tip acuminate; unequally biunguiculate, the inferolateral margin with a series of three to five acute black spines.

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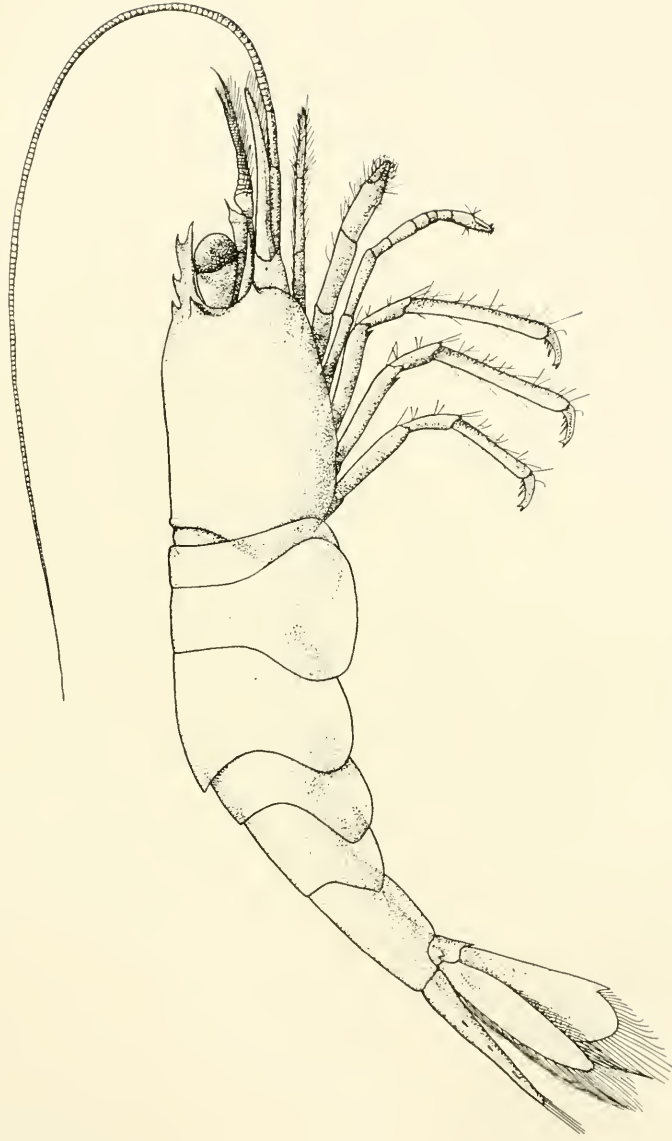
Genus: THOR Kingsley

Thor spinosus, new species

Plate 52

TYPE: The type was collected in coral, Temukus Roads, Bali, Dutch East Indies, October 25, 1931, by the "Alva."

DISTRIBUTION: Restricted to the type.



Thor spinosus, new species, type, $\times 15$.

TECHNICAL DESCRIPTION: Carapace cylindrical, definitely compressed laterally, produced dorsally to a short, triangulate rostrum, which is crested; there is one epigastric spine and the short, laminate, crested rostrum bears two coarse, subequal, triangulate upward-directed teeth, which are larger than the epigastric tooth, in addition to the rostral apex, which itself forms a slightly longer, slenderer tooth, directed straight forward, with the apex not extending any farther forward than does the cornea. There is a very strong, acute, supraorbital spine. The infraorbital angle is not spinose. There is a small, sharp antennal spine. The anterolateral angle of the carapace is rounded. The abdominal segments are moderately compressed laterally and the third segment is produced to a small median point posteriorly; the sixth segment is only one and one-fourth times as long as the fifth, or four-fifths as long as the slender, tapered telson, which bears dorsally three pairs of subequally spaced, articulated spines; the distal telsonic margin is truncate and set with six close-set spines, the innermost pair of which is the longer. The uropoda are slender, both blades being narrowly ovate, the inner one being about one-sixth longer than the telson, and the outer blade, which is the wider, longer than the inner blade in the same ratio.

The eyes are large, forward-directed, set on thick, cylindrical stalks; the cornea is terminal, hemispherical, longer on the lower and outer than on the upper side; distally no longer than the rostrum; also equal in length to the basal peduncular antennular article.

The antennulae have the first peduncular article laminate, deeply cleft on the outer lateral margin, this terminating in an acute, spine-like tooth that projects obliquely forward almost as far as the outer distal tooth of the short, thickened second joint; the third joint is closely fused with the second joint and quite convex dorsally, tapering to an acute median spine distally; the flagellum is two-branched, the upper branch is about one and one-third times as long as the peduncle and very thick, closely fused articles having the aspect of a clumsy, thick, scaphocerite, the proximal four or five articles being dorsally convex, the distal two-thirds of the wide portion less so, thick, followed by a narrowed, thread-like whip that comprises the distal fourth of the flagellum and extends not quite so far as does the scaphocerite. There is the appearance of a groove or cleft obliquely on the upper

surface of this fleshy portion of the flagellum. There is a brush-like formation of setae on the distal outer lateral margin of the thick portion of the flagellum. The lower flagellum, which is very slender and cylindrical throughout its length, arises beneath the upper flagellum and extends four or five articles beyond the latter, or as far as does the scaphocerite.

The antennae have a short basal article supporting a quite long scaphocerite, which is five-sixths as long as the carapace with the greatest median width two-thirds of the length, the outer lateral margin straight, with an acute tooth subdistally, the convex distal margin slightly longer than this tooth; the second and third articles are slender; the flagellum is thread-like, about as long as the entire body.

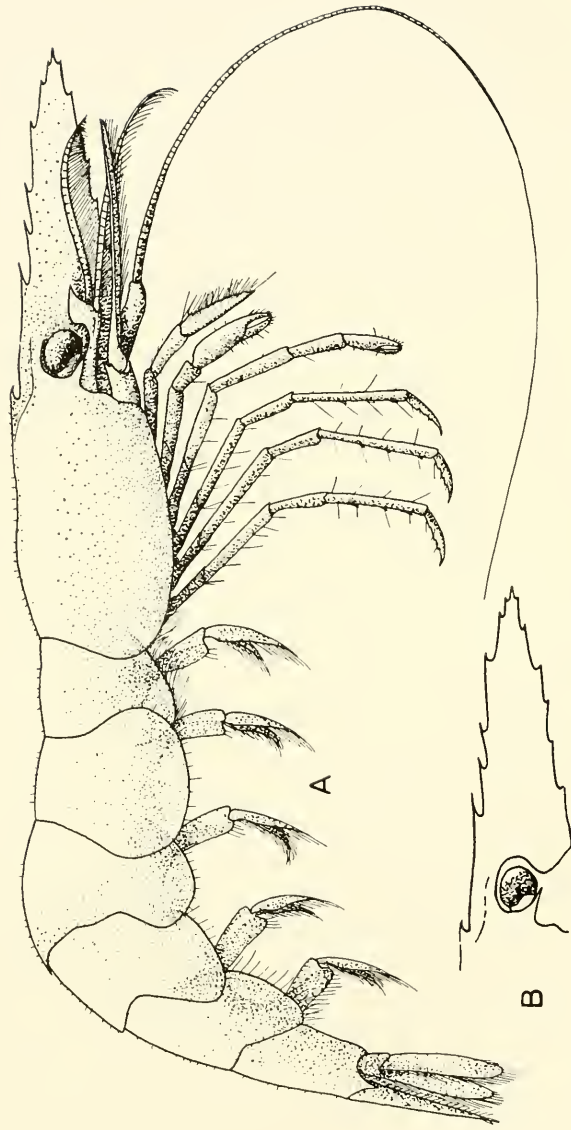
The external maxillipeds are long, pediform, with the distal article elongate, cylindrical, distally serrate and with the lateral surface bearing sharp spinules in transverse series.

The mandible is simple, with no palp.

The first pair of legs is short, weakly chelate, when extended reaching to midway the scaphocerite; the meral, carpal and propodal joints are cylindrical, no wider than those of the third pair of legs; the fingers are two-thirds as long as the palm with a minor concavity between the cutting edges, the tips meeting; the fingers are setose distally.

The second pair of legs is long, slender; the ischium and merus are subequal, considered together, reaching to the base of the propodus of the first pair of legs and here reflected upon itself; the multiarticulate carpus measures: first joint, 0.4 mm. long; second joint, 0.6 mm. long; third joint, 0.3 mm. long; fourth joint, 0.15 mm. long; fifth joint, 0.2 mm. long; the propodus and dactyl are equal to the last three articles of the carpus; the fingers are slender, almost half of the length of the palm, with the cutting edges serrulate, and a few setae distally.

The third, fourth and fifth pairs of legs are successively shorter; the third pair, when extended, exceeds the length of the rostrum by about the length of the dactyl of the third pair of legs; the fourth pair extends to about three-fourths of the length of the propodus of the third pair and the fifth pair has about the same ratio to the fourth pair of legs. All have the dactyl 0.3 as long as the propodus, biunguiculate, and armed also with two or three accessory spines on the inferior lateral margin. The



Latreutes mucronatus (Stimpson), A, profile view;
B, supplementary view of rostrum, both $\times 10$.

dactyl of the fifth leg is not different from those of the preceding ambulatories.

This species, which is very close to *Thor paschalis* Heller in general appearance, differs in the presence of a strong supra-orbital spine, in the different rostral dentition, and in the shape, length ratio of the scaphocerite and in having two lateral spines proximally on the scaphocerite. It differs from *Thor discosmatis* Kemp in having five joints in the carpus of the second pair of legs; in the shape of the scaphocerite and dentition of the proximal lateral margin of the scaphocerite; also in the rostral dentition, the present species having one epigastric and two rostral teeth besides the apical tooth. The present species has six spines on the distal margin of the telson, where *discosmatis* has eight spines. It differs also from *T. maldivensis* Borradaile in the rostral dentition and length ratio. The writer is aware that the specific characters are very delicate, yet the present specimen does not fall within any of the three species recognized by Dr. Kemp in his excellent monograph.

None of nearly a hundred specimens of *Thor paschalis* Heller, from various localities in Florida, the West Indies and Caribbean coast, examined by the present writer, had a supraorbital spine, although much variation in the rostral dentition occurred.

Genus: LATREUTES Stimpson

Latreutes mucronatus (Stimpson)

Plate 53

TYPE: The type was collected in Hong Kong and, if extant, is probably in the Philadelphia Academy of Natural Sciences.

DISTRIBUTION: This species is rather widely distributed in the Indo-Pacific, having been reported from the Red Sea, the southeast coast of Arabia (Nobili); two localities in the Ramnad District, southern India, Port Blair, Andamans (Kemp); Chemulpo, Korea, Sagami Bay, Japan, Gulf of Siam (Balss); Sagami Bay (Doflein); Hong Kong (Stimpson); Java (Nobili); Muntok, Dutch East Indies (Boone); Cape Jaubert, Australia (Balss).

MATERIAL EXAMINED: Two specimens, Muntok, Banka Island, Banka Straits, Dutch East Indies, November 5, 1931, by the "Alva."

TECHNICAL DESCRIPTION: Mr. Kemp's excellent description of this species is an invaluable reference for other students. The "Alva" specimens, both of which are males, apparently are the first record of this interesting little shrimp from Muntok, the nearest previous record being Java, reported by Dr. Nobili. The specimen from Muntok has the rostrum little more than twice as long as the median width; excavate ventrally above the eye; the rostral formula being $\frac{7+1}{6}$; the teeth being on the distal half. The carapace is compact, dorsally arched, with one tooth at the base of the rostrum. The antennal tooth is acute and there is a series of denticles, ten to twelve, on the anterolateral margin. The abdomen is compact in the female, more slender in the male. The sixth abdominal segment is twice as long as the fifth and the telson is tapered, terminating in a triangulate apex, armed by an inner pair of long spinules that exceed the length of the apex, and outside of these a pair of shorter spinules. The uropoda have the outer blade shorter and wider than the inner blade; the outer blade is about three and a half times as long as its maximum width.

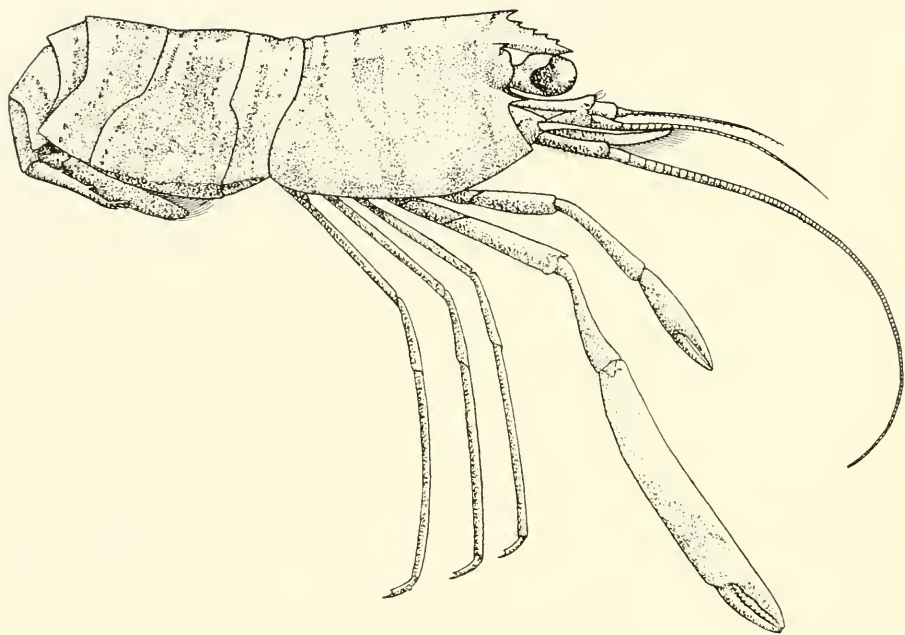
The eyestalk is thicker than the cornea and is produced into a pointed process at the inner distal angle.

The antennular peduncle has the distal margin extending slightly beyond midway the scaphocerite.

The antennae support a well-developed scaphocerite, about three times as long as wide, with the outer lateral margin nearly straight, or slightly concave, terminating in an acute tooth distally, with the inner lateral margin crenulate, the blade being very narrowed distally, widest about one-third of the length from base, thence tapered in both directions, but more so distally. The male scaphocerite is usually slenderer than that of the female.

The second pair of legs, when extended, reach about as far as does the rostrum. The carpus is three-jointed, the second joint being about twice as long as the first, which is subequal to the third joint; the palm is somewhat longer than the distal carpal joint and is also longer than the related fingers.

The third, fourth and fifth pairs of legs are similar, each having the dactyl over one-third as long as the related propodus, armed with a series of three or four spines on the inferior margin and with a two-spined tip.



Gnathophyllum americanum Guerin de Menéville, $\times 10$.

- REFERENCES: *Rhyncyclus mucronatus*, STIMPSON, W., Proc. Acad. Nat. Sci. Phila., vol. XII, 1860, p. 28.
- Latreutes mucronatus*, DOFLEIN, F., Abhandl. Bayerisch. Akad. Wiss., Bd. XXI, 1902, p. 638, pl. 5, fig. 6.—BALSS, H., Beitr. Naturges. Ostasiens Decapoda II, Abh. d. II, Kl. d. K. Akad. d. Wiss. II, Suppl. Bd. X, Abh. 1913, p. 47, text fig. 27.—KEMP, S., Records Indian Mus., vol. X, 1914, p. 101, pl. 3, figs. 8-15, pl. 4, fig. 12; Ibid., vol. XII, 1916, p. 396.—BALSS, H., K. Svensk. Vet.-Ak. Handl. Stockholm, Bd. LXI, no. 10, 1921, p. 10.
- Latreutes gravieri*, NOBILI, G., Bull. Mus. Nat. Hist. Nat. Paris, t. X, 1904, p. 231; Bull. Sci. France et Belg., t. XL, 1906, p. 39, pl. 3, figs. 5-5a.
- Latreutes mucronatus* variety *multidens*, NOBILI, G., op. cit., 1906, p. 41, pl. 2, fig. 3.

Family: GNATHOPHYLLIDAE

Genus: GNATHOPHYLLUM Latreille

Gnathophyllum americanum Guerin de Menéville

Plate 54

NAME: Zebra shrimp; banded shrimp.

TYPE: Guerin de Menéville's type came from Cuba and is deposited in Poey Museum, Havana.

DISTRIBUTION: This minute species is tropicopolitan. It has been recorded from Bermuda Islands (G. B. Goode, J. M. Jones' collections, also A. E. Verrill); Cuba (Guerin de Menéville); Porto Rico, Gulf of Mexico, 26-27 fathoms (M. J. Rathbun); Bluff, Natal South Africa (Stebbing); Mauritius (Richters); Port Jackson, Australia (Stimpson, Haswell); Tahiti (Ortmann, Boone); Hawaiian Islands, Albatross Station 3921, south coast of Oahu Island (Rathbun); Palmyra Island (Edmondson).

MATERIAL EXAMINED: One specimen taken on Venus Point Reef, Tahiti, Society Islands, August 15, 1931.

COLOUR: This species possesses widely varying color patterns. A typical West Indian specimen described by Dr. Verrill had the following pattern: "In life the (ground) color is white, crossed by ten or more conspicuous, narrow, orange bands, some of which are incomplete. The bands are formed of small, close specks of

orange; on the sides of the carapace are six to eight oblique divergent lines of the same color, one of which begins on each side of the base of the rostrum; three radiate from the orbits of the eyes; one is nearly transverse; there is also a spot on the cardiac region. Antennae and antennulae orange; legs are banded with orange."

Stimpson, describing a Pacific specimen, gave essentially the same pattern, except that the color bands were reddish-brown on white. Other writers have described Pacific specimens as banded with purplish-red on cream.

TECHNICAL DESCRIPTION: Species small. Carapace rather stout, compact, dorsally broad, produced to a median rostral carina from about half-way its length, this carina continues forward dorsally as far as the first peduncular article of the antennulae, as a thin, laminate carina obliquely truncate distally, serrate with five or six teeth and an acute tip; the lower lateral margin is slightly expanded into a carina-like margin that is continuous with the orbital margin. The carapace has a bent-in, or depressed area behind the eye. The antennal spine is acute, the anterolateral angle is produced and closely appressed to the body. The abdominal segments are also broad and have capacious epimera on the first three segments, while those on the fourth to seventh segments, inclusive, are rather abruptly tapered and deflexed; the sixth segment is not greatly elongated, about two-thirds as long as the short telson and posteriorly sinuate with paired triangulate processes; the telson is only one-half as long as the uropoda, dorsally slightly convex without a median carina, as noted by Verrill; laterally the margins taper to a narrow subacute apex which terminates in a median papilla. There are two pairs of articulated spines present, one of each pair situated on either lateral margin, the proximal pair placed about midway the telsonic length, the second pair half-way between the first pair and the distal margin; the distal telsonic margin bears six spines, the submedian pair being half as long as the second, or intermediate pair, which are quite long, about half as long as the telson, each tapered, triangulate; the outermost pair are slightly shorter than the submedian pair, but a little larger than the preceding pair of spines on the lateral margin. The uropoda have a small peduncle and broad, long oval blades, the maximum width being slightly more than one-third the length; the outer blade has a strong sutural

tooth and an articulated spine just inside the tooth. The widely convex margins of both blades are crenulate, ciliate.

The eye is very prominent, the stalk cylindrical, shorter than the cornea, which terminates in a faceted papilla.

The antennulae are quite small, the peduncle short, the basal article has a broad stylocerite with two subequal spiniform denticles; the flagellum has the outer branch thick for the proximal six to eight articles, thence deeply cleft, the inner branch consisting of five or six very small setose articles, the outer branch composed of seven slender elongate articles. The inner antennular flagellum consists of fourteen to sixteen slender articles and extends a short distance beyond the outer branch.

The antennae have the peduncle longer than that of the antennulae; the basicerite strong, with a strong acicule; the third article is cylindrical, equal on both sides in the present specimen (but said to be variable, sometimes unequal); the scaphocerite is one-half as long as wide, a broad, ovate, with a subdistal tooth on the outer margin. It extends beyond the antennular peduncle for one-fifth of its length. The antennal flagellum is quite long, slender.

The first pair of legs of the female is subequal, quite small and slender, when extended, reaching only to the base of the palm of the second legs or great chelipeds, and has the carpus elongate, slenderly obconic, with a distal spine; the propodite is about as long as the carpus, the palm being three-fifths of this total length, subcylindrical, not appreciably larger than the carpus; the fingers slender, tufted with bristles distally.

The second pair of legs is about one and one-half times as long as the carapace; the meral joint is slender, one-fourth longer than the ischium, arched, and bears a distal tooth; the carpus is about one-sixth longer than the merus, slender; the propodus has the palm elongate, convex, but somewhat compressed laterally; the palm is twice as long as the carpus, and the fingers, which are slightly down-bent throughout their length, are one-half as long as the palm, tapered, with the cutting edges meeting, faintly dentate, the tips acute.

The three pairs of ambulatory legs are similar, very slender, flattened. The first ambulatory measures as follows: merus, 2 mm. long; carpus, 1 mm.; propodus, 2 mm.; dactyl, 0.4 mm., with biunguiculate tip, which is but little curved, the outer apex being

the longer, the inner apex the wider and thicker basally; both apices are decidedly divergent, with acute curved tips.

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Gnathophyllum zebra, RICHTERS, F., in Möbius, K. A., Meeresfauna Mauritius u. Seychellen, 1880, p. 161, pl. 17, figs. 18, 20, 22.

? *Gnathophyllum pallidum*, ORTMANN, A., Zool. Jahrb. Abth. Syst., Bd. V, 1890, p. 537.

Family: CRANGONIDAE

Genus: PONTOPHILUS Leach

Pontophilus vanderbilti, new species

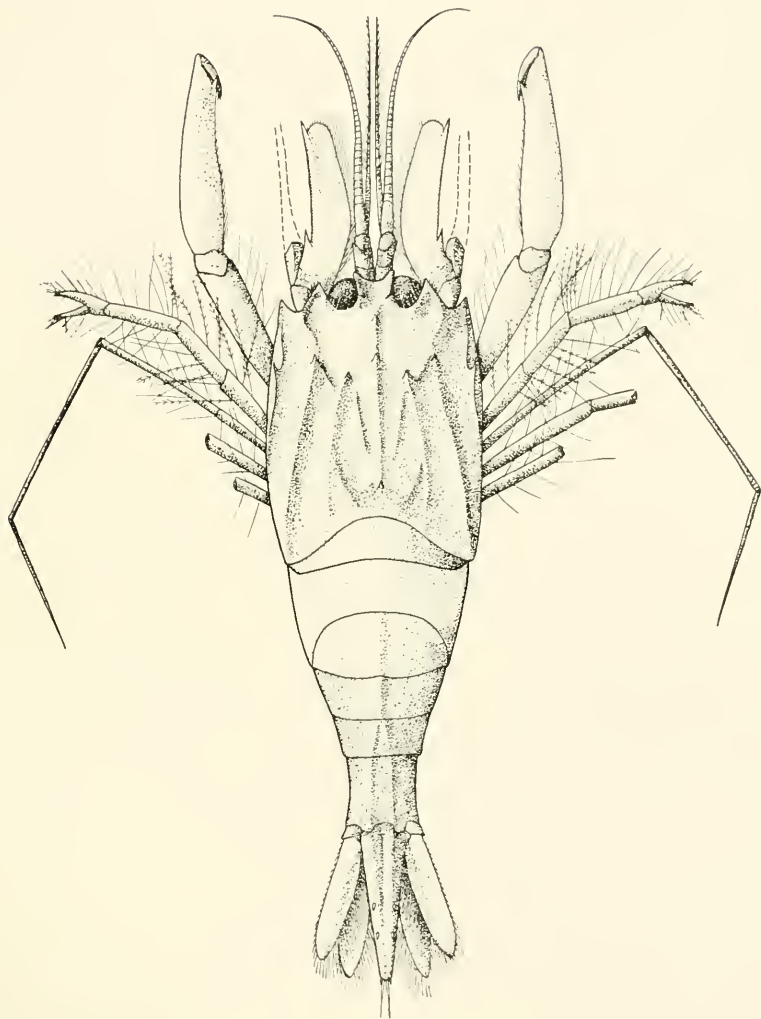
Plate 55

TYPE: One ovigerous female, dredged in 140 fathoms, in Flores Strait, near Larantuka Village, Flores Island, October 22, 1931.

DISTRIBUTION: Restricted to the type locality.

MATERIAL EXAMINED: Type.

TECHNICAL DESCRIPTION: The present species finds its nearest congener in *Pontophilus japonicus* Doflein, which it closely resembles in the rostral formation and also in the ornamentation of the four posterior segments but from which it is unquestionably distinguished by: the different arrangement of carinae on the carapace and the differently shaped and toothed antennal scaphocerite. *Pontophilus vanderbilti* is also near *P. incisus*



Pontophilus vanderbilti, new species, type, $\times 6.7$.

Kemp, in similar scaphocerite and similar ornamentation of the posterior four abdominal segments but again differs in the carinae on the carapace; those of the present species have each only one anterior spine, while on Mr. Kemp's *P. incisus* the carinae each bear several spines; also *P. vanderbilti* has seven major carinae, while *P. incisus* has only five major carinae.

The rostrum is wider by one-fifth than one eye and is deeply concave or trough-like from the orbital angle to the distal rostral border, which appears linear, concave in a dorsal view, but in reality has the tip bent down at an approximate right angle and produced into a deep median lobe, which is distally widely rounded, the distal lateral margin on either side of this deep median lobe is shallowly convex, tapered toward the outer lateral angle, giving the lower, or distal margin a trisinuate contour. The orbital margin is subcarinate, separated by a small, supra-orbital notch from the rostrum and the infraorbital angle is a rounded process; the anterolateral angle is an acute triangle. The carapace is short and wide, median width about eighty-five per centum of the length taken from tip of rostrum to posterior margin. There are seven primary carinae and two secondary carinae present on the carapace. The median dorsal carina begins immediately behind the base of rostrum as a short carina terminating anteriorly in a single tooth; this short carina runs back nearly one-fifth the length of carapace; immediately behind it another small tooth tips the remaining portion of the median carina, which extends back almost to the hind margin. The uppermost lateral carinae consist of a very short oblique pair near the posterior margin, beginning slightly behind the cervical groove and extending obliquely forward and outward, almost touching the second pair of lateral carinae. The second pair of lateral carinae are 1.5 times as long as pair I and lie obliquely between the median dorsal line carina and pair III of the lateral carinae, arising in a small tooth about one-third of the distance from the posterior margin of carapace and near the median dorsal carina and extending obliquely almost to the anterior end of lateral carinae pair III. Lateral carinae pair III arise near the posterior margin and extend forward about two-thirds of the length of carapace, terminating in an acute small tooth which is slightly posterior to the second tooth of median carina. The lateral carinae pair IV are the shortest of the entire series and quite oblique;

they arise near the distal end on the outer side of carinae pair III and extend obliquely almost to the distal posterior tooth of pair V. The lateral carinae pair V arise each at the apex of the postorbital tooth and curve back inward on the carapace, terminating just anterior to the short spine that tips the apex of the remainder of the second portion of this carina; the spine mentioned is approximately opposite the second spine of the median dorsal carina. Lateral carinae pair V run obliquely outward almost to the posterior margin of the carapace. The outermost pair of lateral carinae are also long, beginning at the branchiostegal angle and extending posteriorly almost to the hinder margin of the carapace; about one-fourth of their length from the frontal margin, these carinae each bear one acute spine, which is approximately in line with the spine of lateral carinae pair V.

The median carina bears three spines, one distal, just posterior to the base of the rostrum and continued back as a short carina that ends just anterior to the second spine, which latter is approximately in line with the anterior spines of the lateral carinae pairs V and VI; the third spine of the median carina is very posterior in position, being a short distance from the hind margin and also accentuated on either side by a faint depression.

The abdomen has the third and fourth segments carinate in the median dorsal line, while on the fifth segment there is a double carinae, V-shaped, bifurcating posteriorly, while on the sixth segment there is a double longitudinal parallel carinae. The sixth segment is one and a half times as long as the fifth segment, and the telson is not quite one and a half times as long as the sixth segment, with a median longitudinal depression, bordered on either side by paired carinae, which converge distally and bear two pairs of articulated spines on the distal half. The distal telsonic margin bears a submedian pair of acute, long spines, which are approximately one-fourth of the total length of the telson, and outside of these there is a pair of small articulated spines, one on either side of the long spines and situated at the distal angle of the telson. The uropoda have the blades slender, elongate-oval, setae-fringed distally.

The eyes have the cornea rather large, nearly spherical, well hooded by the carapace.

The antennulae afford no specific characters.

The antennae have the scaphocerite armed, with an acuminate

tooth on the proximal outer lateral margin, the remainder of this margin nearly straight, crenulate, and terminating distally in an acute tooth, which extends beyond the convex distal border of the remaining portion of the blade; the inner lateral margin is convex; the scaphocerite attains its greatest width about two-fifths of the length from the base.

The chelipeds are subequal, with the propodal articles approximately two-thirds as long as the carapace, slender, subcylindrical, moderately dilated on the proximal two-thirds, narrowed distally and dorsoventrally; compressed distally, with the distal margin thin, oblique; a small, acute, out-jutting finger, which projects beyond the hinged finger. The distal margin of the propodus is widely curved, laminate. The hinged finger is slender, rounded, compressed, distally acuminate and bowed or curved to fit closely upon that of the thumb.

The second pair of legs is weakly chelate.

The third pair of legs is monodactyl, exceedingly slender, ending in a stylet-like dactyl.

The fourth and fifth pairs of legs are similar, each definitely thicker than the third pair of legs.

The present specimen is a female, carrying about fifteen large, rather ovoidal eggs attached to the long cilia of the pleopoda. These eggs are quite well developed, the embryos showing subcircular eye-spots, also the segmentation of the abdomen, which is coiled beneath the carapace.

This species, which is superficially like *Pontophilus japonicus* Doflein, is rendered distinct by the different number and arrangement of carinae on the carapace; the present species having, in addition to the three-spined median carina, six pairs of lateral carinae, three pairs of these being short, oblique, the remaining three pairs being, respectively, one pair two-thirds the length of the carapace, while the two outer pairs each extend the full length of the carapace. The present species also has a strong lateral tooth proximally on the outer margin of the scaphocerite. *P. japonicus* has none here.

This species is dedicated to the collector, Mr. William K. Vanderbilt.

Order: EUPHAUSIACEA

Family: EUPHAUSIIDAE

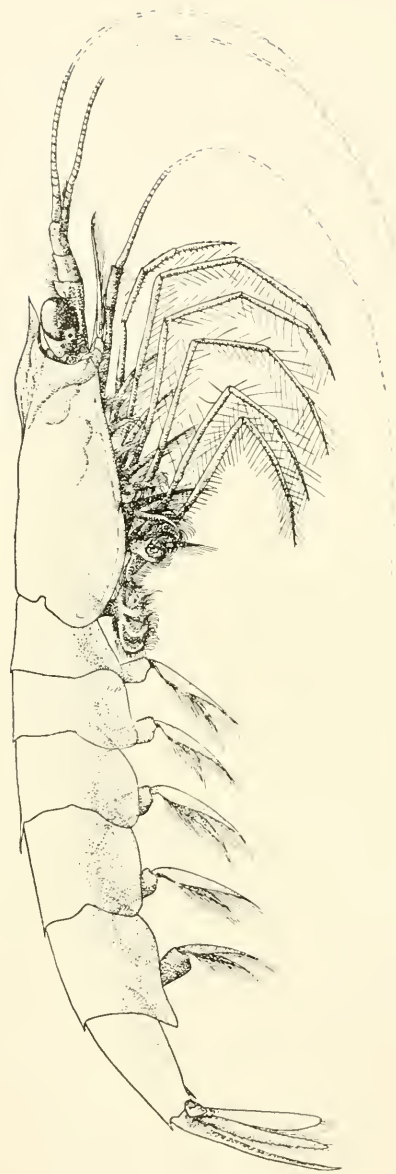
Genus: EUPHAUSIA Dana

Euphausia alvae, new species

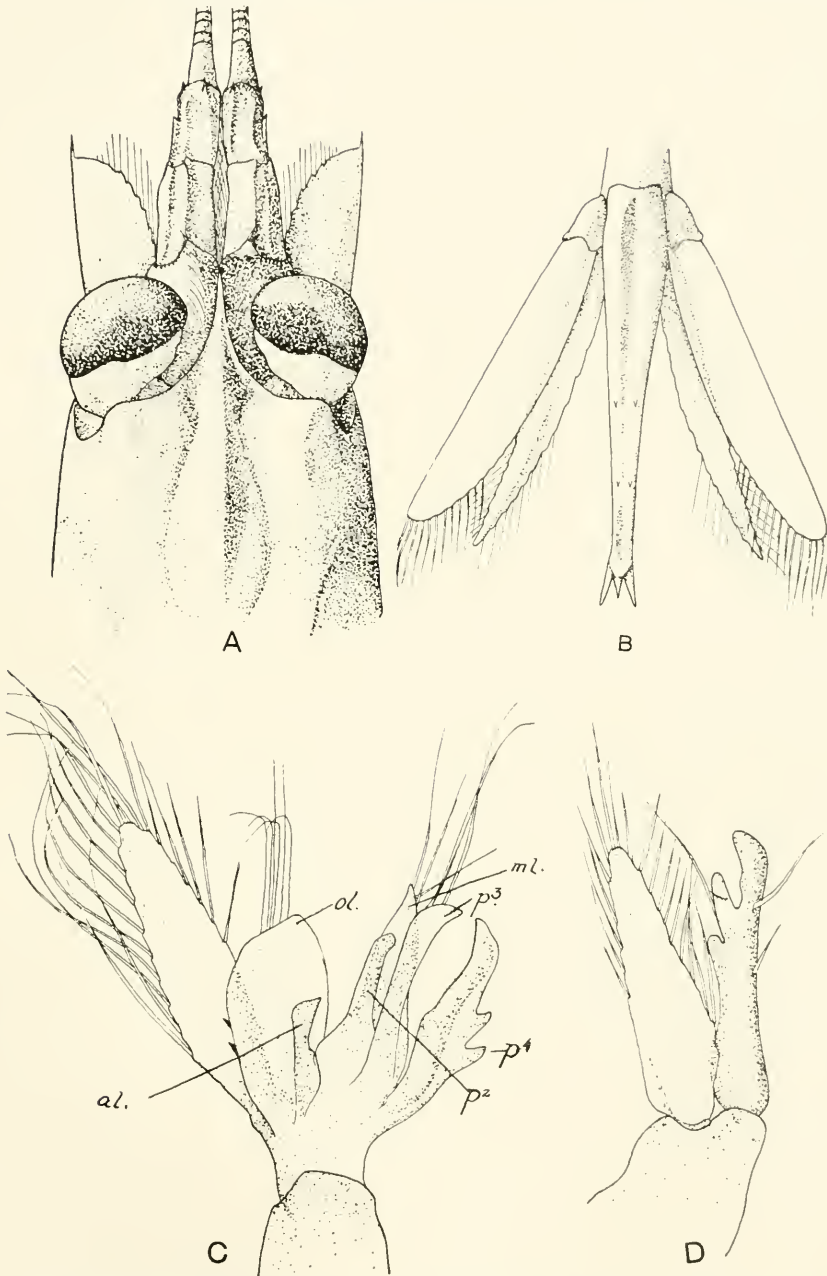
Plates 56 and 57

TYPE: The type series consists of 32 males and 49 females taken by the "Alva" in 140 fathoms (500 meters of wire out), near Larantuka Village, Flores Island, Flores Straits, October 22, 1931.

TECHNICAL DESCRIPTION: This is an *Euphausia* of the *E. similis*, *crassirostris*, *tenera* group, having but one lateral denticle. This is placed about midway the length of the carapace. The rostrum of the present species is much as in *crassirostris*. It begins as a definite laminate carina just anterior to the cervical groove and is dorsally convex on the proximal portion, thence narrowed and concave on the distal two-thirds; the rostral blade beyond the carapace is directed obliquely upward and extends as far as midway the cornea. The rostrum tapers to an acuminate tip and for the distal third of the length is purely laminate, the proximal two-thirds has the inferior rostral margin continuous with the orbital margin, thus forming an expanded triangle proximally, if viewed dorsally; below this lateral expansion the rostrum on the proximal inferior margin is expanded, ventrally convex for a short distance. The cervical and hepatic sutures are deep and there is also dorsally a deep sulcus on either side of the rostrum, curving obliquely back to the main cervical groove and separating the rostral and orbital areas. The orbital region is dorsally convex and distally hood-like, with the frontal margin convex, slightly projecting, but not extending any further than the eyestalk joint. The hepatic branch is deep and coalesces with the deeper, outer branch of the cervical groove, which delimits the orbit on the lower side and extends to the inferior lateral margin. Below this in the median lateral area there is a sinuate, or double crescentic sulcus, as depicted. (Plate 57). The anterolateral angle is an acute tooth. The postlateral margin of the carapace is transversely excavate in the median region and broadly rounded on both sides. The third and fourth abdominal segments each terminate posteriorly in the median dorsal line in a small triangulate tooth, that of the third segment being the longer, extending upon the fourth segment for nearly one-eighth of its length, while the spine of the



Euphausia alvae, new species, type, \times greatly enlarged.



Euphausia alvae, new species, type: Dorsal view of anterior end of carapace and appendages $\times 18$; B, rhipidura $\times 20$; C, specialized male first pleopod, with the inner organ unrolled and drawn from the posterior lateral side; D, second male pleopod, with the inner organ shown from the posterior lateral side; D and C $\times 40$.

fourth segment is only one-fourth as long as the spine of the third segment. The sixth abdominal segment is one and a half times as long as the fifth segment and has the postlateral angle a simple blunt triangle. From the median ventral surface of the sixth segment there arises a single, strong, curved spine, directed posteriorly, as in *E. similis*. The telson has the general contour of *E. similis* G. O. Sars, but has a definite median longitudinal groove, margined on either side by a coarse carina; upon these carinae there are situated two pairs of articulated spines. The distal margin of the telson is stylet-like, margined on either side by one of a pair of long, stylet-like spines, each of which projects the distal third of its length beyond the apex of the telson. The uropoda are quite like those of *E. similis*, with a short peduncle and the inner blade a little shorter than the telson, very narrow; the lateral margins coarsely crenulate, converging to a subacute apex. The outer blade is slightly longer than the inner blade, but is also shorter than the telson, and has the inner margin crenulate, the distal margin narrowly rounded.

One of the most distinctive specific characters of *E. alvae* is to be found in the antennular peduncle. The first peduncular joint has the distal lobe directed outward and upward and consists of a single, proximally wide, triangulate, acuminate process arising on the inner half of the distal margin and bent somewhat outward and upward, projecting a third of the length of the second article; the outer half of the distal margin is coarsely crenulate, but there is no secondary triangular process, such as is found in *E. similis* and variety *crassirostris*. The second peduncular article of *E. alvae* terminates distally in a strong tooth at the upper distal angle and a similar lesser tooth at the inferior distal angle; there are two longitudinal light carinae on this joint, the outer one being subparallel to the outer lateral margin, and the inner carina, also extending the length of the joint, is nearly parallel to the outer carina, being only a little closer to it distally than proximally, as depicted. The third peduncular joint is very distinctive, in that it has double longitudinal carinae; the inner one extends nearly the entire length of the article and terminates in an acute subdistal tooth directed forward and upward; the second carina is along the outer part of the upper side of the article and proximally is subparallel to the inner carina, but distally the outer carina curves inward, almost touching the inner carina. Below

this outer carina, on the outer lateral surface of this third joint, there is a third carina, short, extending only the proximal half of the joint, thinner than the dorsal carina and terminating distally in a rounded denticle, immediately beyond which there is a constriction, followed distally by a second, submarginal denticle. The distal dorsal margin of the third joint is sinuate, with a small, acute process at the outer distal angle. (Plate 57, fig. A).

The specialized male first pleopod has the outer blade of the usual shape but armed with two well separated, small, acute, articulated spines on the outer lateral margin. The inner organ is complex, tubular, the outer lobe being irregularly oval, narrowed proximally, concave on the posterior lateral surface, bearing distally midway the margin a group composed of four long, fishhook-like setae and two upright setae; the median lobe has a distinctive, eccentric tubular formation, its lateral outline being curiously sinuate, tapered distally, even when the organ is unrolled, the side margins of this median lobe remain curved over inward, tube-like; there is a small, tapered, distally curved lobe, obscurely placed between the outer and median lobes; the terminal process (p. 2) is shorter by half than the proximal process (p. 3), both terminate distally in curved, hook-like formations. The lateral process (p. 4) is rather short, triangulate, acuminate. (Plate 57, fig. C).

The second male pleopod also has the inner blade specialized, being semitubular, with the posterior lateral surface concave, the distal end consisting of two rounded processes; the inner lateral margin is produced in a separate, elongate-ovate lobe about midway its length, more proximally; this same lateral margin has another small lobed incision. (Plate 57, fig. D).

I have associated the name of the yacht "Alva" with this species.

***Euphausia consuelae*, new species**

Plates 58 and 59

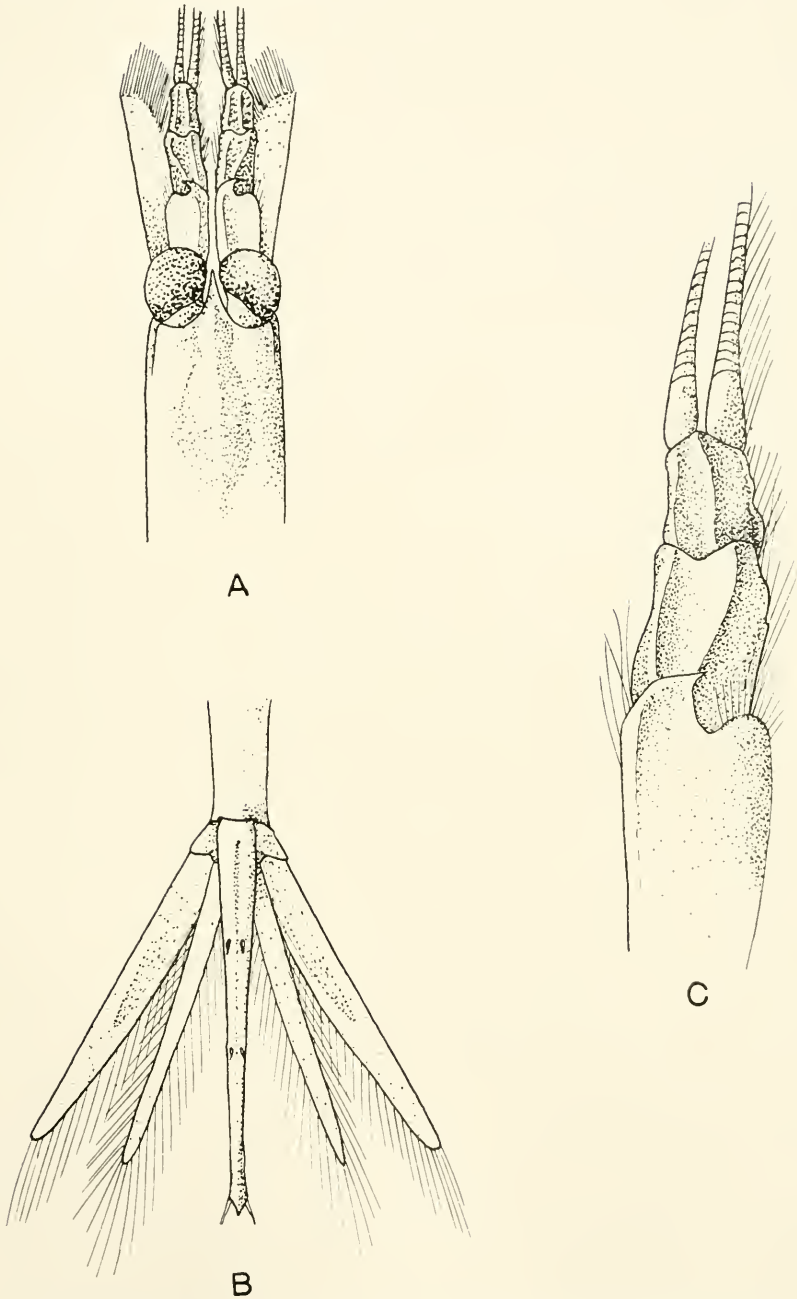
TYPE: The type series consists of thirteen specimens, including both male and female adults, dredged in 250 fathoms, off Ame-tejum Island, New Hebrides, September, 1931, by the "Alva."

DISTRIBUTION: Bathypelagic, in the Pacific Ocean, off New Hebrides.

MATERIAL EXAMINED: Type series.



Euphausia consuelae, new species, type, $\times 6$.



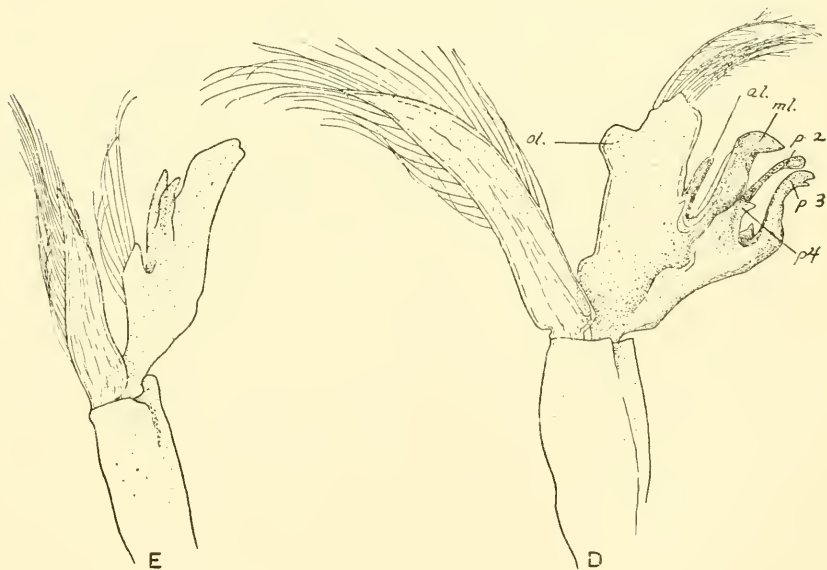
Euphausia consuelae, new species, type: Dorsal view of anterior end of carapace and appendages; B, rhipidura; C, dorsal view of antennular peduncle; all are greatly enlarged.

TECHNICAL DESCRIPTION: This species also belongs to the group with one lateral spine, which in the present species is located slightly anterior to midway the length of the lateral margin of the carapace.

The rostrum begins as a laminate carina, just anterior to the cervical groove, and is convex dorsally, tapering on the distal third to an acuminate tapered point that extends straight forward beyond the carapace for only a short distance, reaching to midway the length of the cornea. Viewed dorsally, the rostrum forms a narrowed, acute triangle, with its lateral margins continuous with those of the orbital area. There is a deep sulcus on either side of the rostrum, curving back to the main cervical groove and separating the rostral and orbital areas; the cervical and hepatic sutures are deep. The orbit is dorsally convex, with the frontal margin rim-like, hooding the eyestalk proximally and leaving only the narrowed distal border of the stalk visible. The hepatic sulcus is deep and coalesces with the deeper outer branch of the cervical groove, which delimits the orbit on the lower side and extends to the inferior lateral margin. The anterolateral angle is an acute tooth. The postlateral margin of the carapace is transversely excavate in the median area and is broadly rounded on either side. The lateral margin has one tooth, situated slightly anterior to midway the length. The third abdominal segment is produced posteriorly to a slender, acute tooth that projects above the fourth segment for about one-fourth of its length. The sixth abdominal segment is one-fourth longer than the fifth segment, or three-fifths as long as the telson. The telson is long, narrowed, exceeding the length of the uropoda, as figured, and proximally bears a median dorsal channel bordered on either side by a longitudinal ridge; there are two pairs of minute, articulated spines dorsally, spaced as figured. The apex of the telson is stylet-like, flanked on either side by a long, articulated spine. The uropoda have a short peduncle, the inner blade shorter than the telson, very narrowed, with the lateral margins crenulate, converging to a subacute apex; the outer blade is also shorter than the telson, but is a little longer than the inner blade, with the inner margin crenulate, the distal margin evenly rounded.

The antennular peduncle has the basal article somewhat concave beneath the eye; the distal margin is produced on the inner half into an auricular process, bent upward and projecting nearly

a fourth of the length of the next segment; the outer half of this distal margin of the first joint is separated briefly from the inner by a small sulcus and the distal outer half of the margin is widely convex and evenly crenulate and setose. The second joint has two longitudinal carinae dorsally, one near the inner lateral margin, extends the full length of the article and terminates in a small tooth at the distal angle; the second carina is not quite parallel to the first, the two being a little wider apart distally than proximally; this second carina is nearly midway the dorsal surface and extends the entire length of the joint and terminates distally in a strong denticle. The third peduncular article is shorter than the second and bears dorsally along the inner lateral margin a strong carina, extending from the proximal margin and terminating in a denticle. The second carina of this third joint extends the length of the joint and is placed nearly midway the dorsal surface; on the outer side of the third segment there is a short, interrupted carina, the proximal part of which is stronger, the distal portion being twice constricted.



Text figure 13—D, *Euphausia consuelae*, new species, type: specialized male first pleopod, with the inner organ unrolled and drawn from the posterior lateral side, E, specialized male second pleopod, also drawn from the posterior lateral side; both greatly enlarged.



Thysanoessa gregaria G. O. Sars, $\times 10$.

The first male pleopod, when unrolled and examined from the posterior side, is as shown in fig. D. The outer blade is of the usual shape with the lateral-distal margins setose. The tubular inner portion, when unrolled, has the large outer lobe of the irregular shape figured, with two flap-like processes, well separated, on the outer lateral margin and with the main distal margin bearing five, multiarticulate setae, each joint of the main seta bearing a small seta distally; the auxiliary lobe is small, semitubular, concave on the inner side; the median lobe is less than half as wide as the outer lobe and shorter, with the distal portion rounded, bent; the terminal process (p. 2) is slender, shorter than the proximal process (p. 3), both are distally curved, beak-like formations; the lateral process (p. 4) is short, triangulate, with the outer lateral margin irregular.

The male second pleopod has the inner blade also specialized, it being semitubular with the posterior surface concave and consisting of a small, broad, blunt, conical lobe situated about the proximal third of the lateral margin, and beyond this two longer, slenderer small lobes arising also from the outer lateral margin; the distal portion of the main lobe is broad, slopingly rounded.

I have associated the name of Mrs. Consuelo Vanderbilt Smith, a member of the expedition, with this species.

Genus: **THYSANOESSA** Brandt

Thysanoessa gregaria G. O. Sars

Plate 60

TYPE: Dr. Sars founded the species on an extensive series of specimens secured by the "Challenger" at seven stations in the South Atlantic, south, also east, of Buenos Ayres, between the Falkland Islands and Patagonia, and other points in the South Atlantic; south of the Cape of Good Hope; off the Australian coast, Sydney to Wellington; in the North Pacific from Japan to Honolulu; surface. The type series is deposited in the British Museum.

DISTRIBUTION: This species has a very wide distribution, ranging in the Pacific as far north as **Japan to Honolulu** and southward in the Australian waters; also throughout the North and South Atlantic and in the Mediterranean Sea.

MATERIAL EXAMINED: Two immature specimens from off the New Hebrides, depth 250 fathoms, October, 1931.

TECHNICAL DESCRIPTION: Carapace slender, rostrum produced almost as far as the distal margin of the cornea, slender, straight, narrowly lanceolate. Carapace short, compact, with a well defined tooth on the lateral margin, situated posterior to the center. Abdominal terga smooth, epimera somewhat angular; the sixth segment is one and one-half times longer than the fifth. There is a strong, curved, preanal spine present, forming a broad plate with the hinder margin serrate. The telson is slender, terminating in a distal stylus and armed on either side by a long spine. The uropoda are slightly longer than the telson; the inner blade is very narrowly lanceolate; the outer blade is a little longer and wider, with a distal tooth.

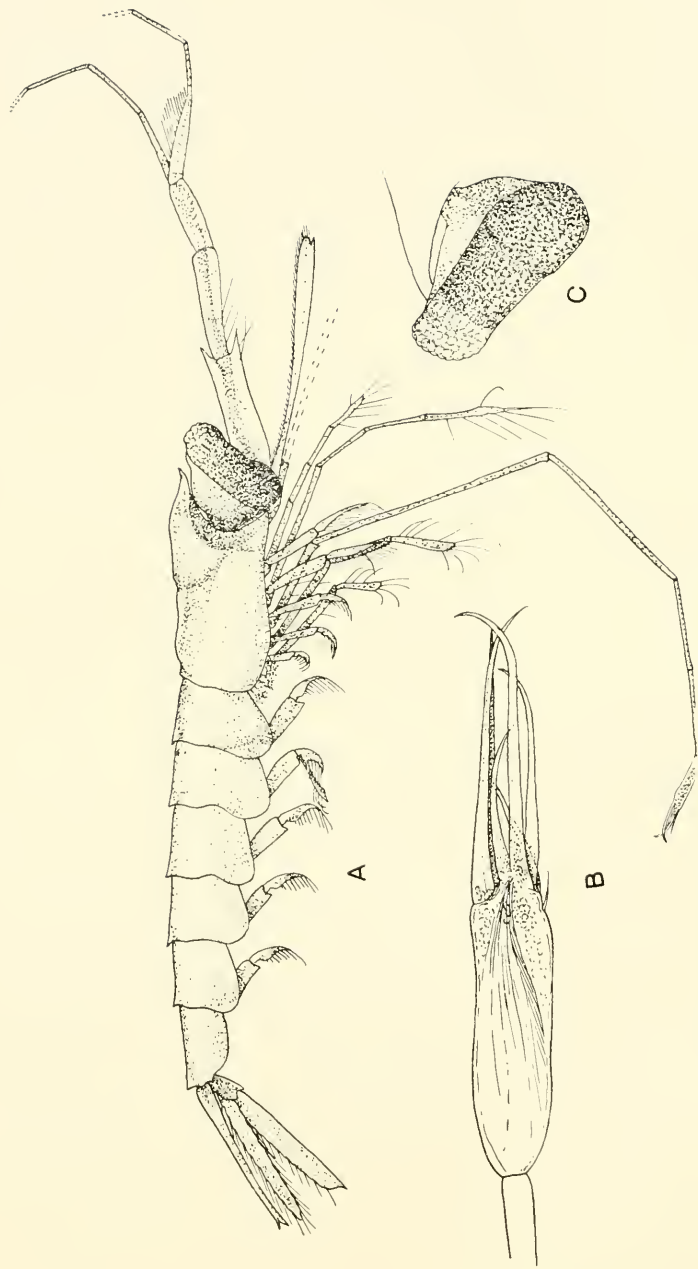
The eyes are characteristically large, unequally globose, the cornea set on a short stalk and being unequally divided by a transverse constriction across the cornea, a little above the center, the upper lobe being the smaller.

The antennulae have the basal article laminate, with the distal border somewhat projecting and densely setose, the outer distal angle with a tooth; the second and third articles are as long as the first and are cylindrical, the third article being a little longer than the second; the flagellum is two-branched, both branches being short, each about one-half as long as the peduncle.

The antennae support a long, narrow scaphocerite, which extends almost as far as the third peduncular article of the antennulae and is tapered toward the obliquely rounded apex, the outer distal angle being acuminate. The basal spine is small, smooth. The flagellum is slender.

The first pair of legs is decidedly the longest of the entire series, being one and one-half times as long as the body; the meral and carpal joints are the longest of the series, the merus being the longest, very slender, tapered distally and very flexibly joined with the carpus, which is also very slender, linear, with six or eight spiniform, multiplumose setae; the dactyl is quite small, armed with five strong, curved spines.

The second to fifth pairs of legs, inclusive, are successively shorter; the second and third pairs having the carpus and propodus subequal, and the dactyl very short, conical; the fourth pair of legs is very small, with the endopod consisting of only two



Stylocheiron longicorne G. O. Sars; A, profile, $\times 10$; B, claw, $\times 30$; C, eye, $\times 35$.

joints and the exopod present. The fifth pair of legs is exceedingly small, rudimentary.

REFERENCES: *Thysanoessa gregaria*, Sars, G. O., Preliminary Notices on "Challenger," Schizopoda, No. 29; Rept. Voy. H. M. S. "Challenger," Zool., vol. XIII, art. Schizopoda, 1885, p. 120, pl. 21, figs. 8-17, pl. 22.

Genus: **STYLOCHEIRON** G. O. Sars

Stylicheiron longicorne G. O. Sars

Plate 61

TYPE: Dr. Sars' type was taken by the "Challenger" south of Cape of Good Hope and deposited in the British Museum. He also recorded the occurrence of the species at Messina, in the Mediterranean Sea, in his original description.

DISTRIBUTION: In addition to the above cited localities, Dr. Hansen states that this species has been taken in the Atlantic, as far north as south of Iceland, Lat. $63^{\circ} 08' N.$, Long. $21^{\circ} 30' W.$ He also records it from the Pacific Ocean, from nine "Siboga" stations, between Lat. $4^{\circ} 27'$ and Lat. $6^{\circ} 47.5' S.$ and Long. $124^{\circ} 28.2' E.$ and Long. $129.25^{\circ} E.$, in depths ranging from 278 to 1,950 meters.

MATERIAL EXAMINED: Three specimens, two females and one male, taken in 250 fathoms, off Puerto Cabras, Fuerte Ventura, Canary Islands, Atlantic Ocean, February 18, 1932. Eighteen more specimens from off Nuka Hiva Island, Marquesas Islands, August 10, 1931, depth 150 fathoms.

TECHNICAL DESCRIPTION: The adult male measures nine millimeters long and is very slender; the carapace has the cervical suture very deep; the precervical portion of the carapace is very little carinate, the rostrum short, acuminate, extending quite to the distal margin of the eyestalk, with the apex a little deflected. The abdomen has the first, second, third, fourth and sixth segments each produced into a small denticle in the median posterior line; the fifth segment is five-sixths as long as the sixth segment. The epimera are well defined, though not very deep and are evenly rounded. None of the specimens in the "Alva" series has a preanal spine, although adults of both sexes are present. The telson is exceedingly slender, almost twice as long as the sixth segment,

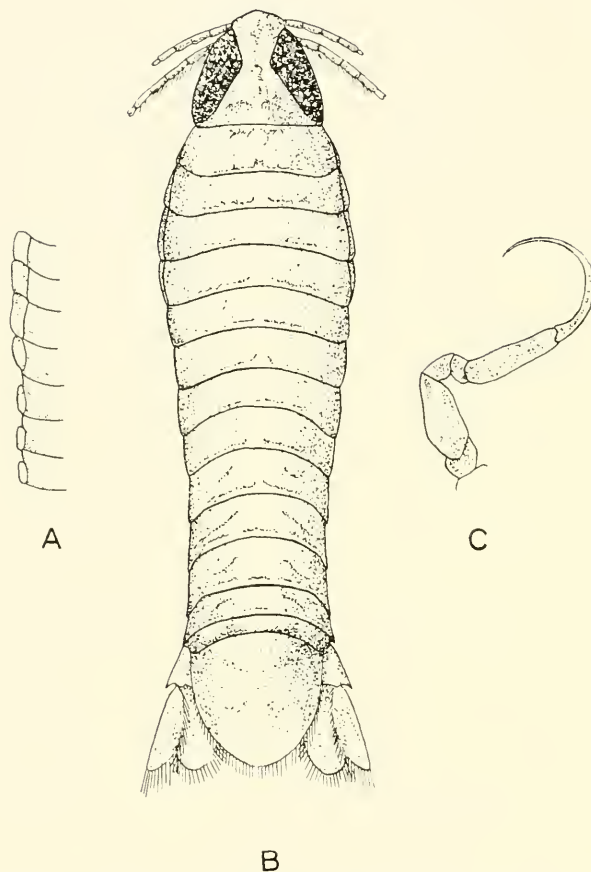
stylet-like, distally flanked by a pair of strong spines, one being on each side of the telson apex. The uropoda have the inner blade narrowed, crenulate, the outer blade slightly wider, both being a little longer than the telson.

The eye is very distinctive, the cornea being 2.4 times as long as wide, or approximately as long as the height of the carapace; the stalk is definitely shorter than its distal width and terminates distally on the dorsal end in a small papilla. The cornea is 2.4 times as long as the width across the center and is approximately cylindrical, with both ends convex, the lower end being five percentum wider than the upper half. The lower almost half of the eye is constricted transversely just below the center of the eye, and this lower portion consists of smaller facets, closely-set; the median, constricted portion is composed of slightly larger facets, also closely-set and beyond this, the dorsal end of the eye is composed of coarser facets, in berry-like formation.

The male antennules have the basal article laminate, greatly elongated, and terminating in an acute tooth at both the inner and outer distal angles; the second article is little more than half as long as the first and the third article is almost as long as and similar to the second article; the outer branch of the flagellum has a tapered, much thickened proximal article that is about one and one-half times as long as the third article and bears a brush of setae on the upper distal margin, beyond which the longer distal portion of the whip becomes quite fine. The inner flagellum is subequal to the outer one in length but is fine throughout its entire length.

The antennae support each a slender scaphocerite, which extends a little beyond the second peduncular article of the antennulae in the female and to midway the third peduncular article in the male and terminates in each, in a minute denticle at the outer lateral margin, and has the inner distal margin unevenly rounded and ciliate; the scaphocerite is about fifteen times as long as the average width. The antennal flagellum is broken in the specimens of the "Alva" series; Sars states that this is "prodigiously elongate, perhaps several times as long as the body."

The second pair of legs is greatly elongated, being a little longer than the entire body, which they exceed by about two-thirds of the length of the false chelae. The latter, in the male, has the structure shown in Plate 61, figure B. The palm-like



Anilocra leptosoma Bleeker: Lateral profile of epimera; B, dorsal view of young specimen; D, third leg; all $\times 14$.

proximal portion of the propodal joint comprises about one-half the length and supports the two primary finger-like spines, which are slender, elongate, much curved distally and overlapping below the apices. This palm-like portion of the propodal joint supports a long primary, or finger-like spine, very curved distally, and arising from the base of this primary on the outer side a long, distally procurved spine, two-thirds as long as the primary, and from the inner side of the base of this primary a second, long, curved spine, which is only half the length of the primary. Also from the base of this primary there is a weaker, shorter, slenderer spine, a little over one-third of the length of the primary, and with the apex directed obliquely inward, toward the upper "finger" or primary. At the base of this weak spine there is a single, very short spinule. The terminal joint is a strong unguiculate primary, distally curved, this portion overlapping below the apex upon the lower "finger." There is one strong, slender spine arising from the base of the upper "finger" and extending closely beside it on the outer side, with the apex not at all curved and extending to that point where the two fingers cross.

The copulatory organ of the specimens of the present series agrees with that figured and described by Dr. Hansen ("Siboga" Report, Pl. 16, fig. 5B).

REFERENCES: *Stylocheiron longicorne*, Sars, G. O., Forh. Vid. Selsk. Christinia for 1883, no. 7, p. 32; Rept. Voy. H. M. S. "Challenger," Zool., vol. XIII, Schizopoda, 1885, p. 144, pl. 27, fig. 5.—HANSEN, H. J., "Siboga"-Expeditie Monogr., XXXVII, 1910, p. 120, pl. 16, figs. 5a-b, Leiden.

Order: ISOPODA
Suborder: Flabillifera
Family: CYMOTHOIDAE
Subfamily: Cymothoinae
Genus: ANILOCRA Leach
Anilocra leptosoma Bleeker

Plate 62

TYPE: Bleeker's type series came from the Indian Ocean, near Batavia, and is deposited in the Leyden Museum.

DISTRIBUTION: This species is quite rare, being known only from the type series from Batavia (Bleeker), and Sumatra and

the Philippines (Schiodte and Meinert, Nierstrasz), and Durian Straits (Boone).

MATERIAL EXAMINED: One immature specimen, representing the second stage of the young, dredged in 14 fathoms, muddy bottom, near Equator, south of South Brother's Island, south entrance of Durian Straits, Lat. 29' N. by Long. 104° 47' E., October, 1931.

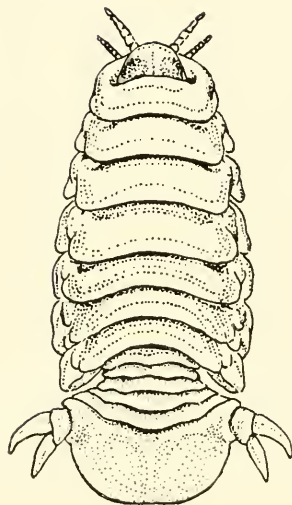
TECHNICAL DESCRIPTION: Head not at all immersed in the first thoracic segment; length in the median line about equal to maximum width, which is across the posterior margin; head triangulate in shape, with the apex produced in a tongue-like process, which arches over the antennal base and is rounded and truncate distally. Eyes large, suboval, composed of coarse ocelli; situated in the lateral region and extending from the posterior margin almost to the base of the frontal process; separated from each other by a space about 1.5 millimeters wide at the narrowest point.

The first pair of antennae is thickish, composed of eight articles, and when extended reach the anterior margin of the first thoracic segment.

The second pair of antennae is slenderer and extend to the posterior margin of the second thoracic segment. Each consists of ten articles; the fifth or last peduncular article is much the longest; the five articles of the flagellum are similar, except that they taper distally.

Thorax: The first and second segments are subequal; the third segment is one and one-third times longer than the second; the fourth and fifth segments are about equal and are subequal to the first segment; the sixth and seventh segments are only a little shorter than the fifth and subequal to each other. The epimera are extended entirely across the second and third segments, the third epimera being the longest of the entire series; on the fourth, fifth, sixth and seventh segments the epimera extend across only the anterior half or three-fifths of the lateral border of the segments.

Abdomen: The first, second and third segments are scarcely differentiated in proportions from the seventh thoracic segment; the fourth and fifth segments are successively slightly shorter and narrower; the telson is longer than wide, the width being only three-fourths of the length; the distal margin is rounded and setose. The uropoda have the peduncle two-fifths as long as the



Cymothoa eremita (Bruennich), $\times 2$.

telson, strong, the inner blade ovate, as long as the telson; the outer blade is a little longer with its outer lateral margin nearly straight, the inner lateral and distal margins rounded, convex. Both blades are setose.

Legs: The legs are all prehensile, the first three pairs being directed forward, the remaining four pairs posteriorly; all the dactyli are hook-like. There are no spines on any joints of the legs.

REFERENCES: *Anilocra leptosoma*, BLEEKER, Verhandel. Natuurk. Ver. Nederlandsch. Indie, vol. II, 1857, no. 5, p. 30, t. I, figs. 6a-b.—SCHIODTE and MEINERT, Naturhist. Tidsskrift., R. Bd. XIII, 1881-83, p. 108, pl. 8, figs. 2, 3, 4.—NIERSTRASZ, H. F., "Siboga"-Expeditie III Isopoda Genuina II Flabellifera Monogr. 32C, 1931, p. 129.

Anilocra alloceraea, KOELBEL, Neu. Cym., Bd. II, p. 7, figs. 1a-c.

Genus: CYMOTHOA Fabricius

Cymothoa eremita (Bruennich)

Plate 63

TYPE: The type is deposited in the Copenhagen Museum (original description not available to the present writer).

DISTRIBUTION: This species has been repeatedly recorded from the Indo-Pacific, where it has been taken parasitic on several different species of fishes at Madras, Pulo Penang, Singapore, Java, Bangka, Mabutua, Menado, Bohol, Marineles Ubay, Legaspi, Japan and the Society Islands.

MATERIAL EXAMINED: One large specimen, taken at Sourabaya, Java, Dutch East Indies, October 28, 1931.

TECHNICAL DESCRIPTION: *Head:* This is subpentagonal, with the frontal part truncated, rounded and obscurely emarginate; the greatest width across the posterior region is equal to one and a third times the greatest length. The eyes are smallish, situated in the postlateral angles of the head. The head is deeply immersed in the first thoracic segment, having the posterior three-fifths surrounded by the produced angles of the first thoracic segment. The first pair of antennae are thick, stocky, composed of eight articles, when extended they are not quite as long as the anterior margin of the first thoracic segment. The three peduncular articles are subequal in length; the first article compressed proxi-

mally; the second and third articles are subequal, as wide as long; the fourth to eighth articles, inclusive, are of approximately equal length, but each is successively narrower, the distal one being quite tapered. The second pair of antennae consist of nine articles; the second pair is much slenderer than the first pair and shorter by the length of the distal article. The second pair of antennae has the peduncular articles less dilated than those of the first pair, the peduncular articles being successively tapered, the distal article is quite minute.

Thorax: The first thoracic segment is as long in the median line as the head and has its anterolateral angles produced around the proximal three-fifths of the head, the outer margins of the segment laterally rounded; the postlateral angle notched; the second, third and fourth segments are subequal, each being a trifle shorter than the first segment; the fifth, sixth and seventh segments are similar, but each is successively a little shorter and has the posterior margins curved. The epimera are short, each one definitely defined from the segment, subcrescentic when seen in a lateral view, posteriorly truncated with the postlateral angle bluntly rounded on the second, third and fourth segments, more produced on the fifth and sixth segments and rounded; on the seventh segment they are less produced, also rounded. Viewed dorsally the epimera are thickened, rounded; the fourth, fifth, sixth and seventh segments are set apart from the epimera posteriorly with a definite notch in the margin, accentuated by a sulcus extending inward, opposite the posterior angle of the related epimera.

Abdomen: The first to fifth abdominal segments are short, compressed, the abdomen deeply inserted, the lateral parts abortive; the telson is decidedly wider than long, 2:1, with the distal margin truncated, weakly bilobed, the lateral area bluntly rounded. The peduncle of the uropoda is flat dorsally, nearly as wide distally as long; the outer blade is a narrow, curved knife-blade shape, tapered distally, slightly longer than the inner blade, but not quite reaching to the distal telsonic margin. The smaller blade is similar to the larger one, but narrower, shorter and with the lateral curvature less accentuated.

Legs: All seven pairs of legs are prehensile, strongly curved, hook-like. The first three pairs are directed forward, while the posterior four pairs are directed backward. The first three pairs

are similar; each is strongly recurved, S-shaped, with the basal article thickened, cylindrical, but not greatly enlarged as are those of the four posterior pairs. The dactyli are strong, curved, pointed, hook-like, closing upon the propodal and carpal joints. The fourth to seventh pairs of legs, inclusive, successively increase in size and each has the basal article greatly enlarged, with the outer side expanded, into a thick process with rounded outer margin. On the fourth pair of legs this process is of moderate size, but on the fifth, sixth and seventh pairs of legs it is successively much more expanded. The dactyli are similar to those of the first three pairs of legs.

REFERENCES: *Oniscus oestrum*, SPENGLER, Besch. Berlin Ges. Naturf. Fr. I, p. 312, taf. 7, figs. i-k.

Oniscus eremita BRUENNICH, Vid. Selsk. Skrift. Nye Saml. II, p. 319.

Cymothoa stromatei, BLEECKER, Arch. Verhandel. Natuurk. Ver. Nederlandisch-Indie, Bd. II, 1857, p. 35, taf. 2, fig. 13.

Cymothoa eremita, SCHIODTE and MEINERT, Naturhistorisk Tidsskrift (3), Bd. XIV, 1883-84, p. 259, pl. 57, figs. 3-4 (*Cymothoa* XXV).

Cymothoa exigua Schiodte and Meinert

REMARKS: For full discussion of this species, consult: Boone, Lee, Vol. III, Bulletin of the Vanderbilt Marine Museum, p. 203, pl. 77, fig. A, 1930.

MATERIAL EXAMINED: Two ovigerous females and one male, taken with submarine light, Conway Bay, Galapagos Islands, July 28, 1931. One large female, taken at Southport, Queensland, Australia, September 24, 1931.

NOTES: The male of this species is not asymmetrical as are the females, and has its median segments narrower, their lateral contour more nearly forming parallel lines, whereas the female contour is more convex.

The larger female, approximately an inch long, is carrying from 150 to 200 large, tough-skinned, opaque, spheroidal eggs.

Genus: AEGATHOA Dana

Aegathoa macrophthalma Dana

Plate 64

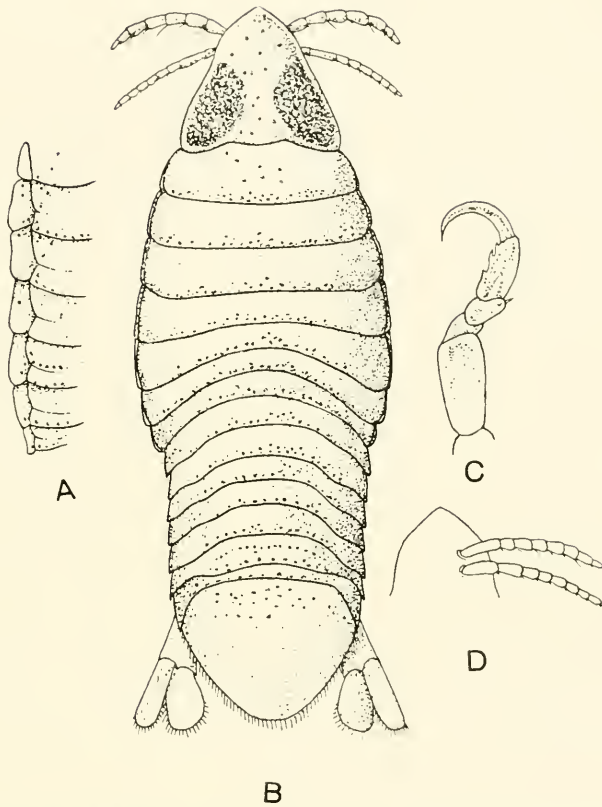
TYPE: Dana was uncertain of the exact locality of his type material, which he cited as "from Nassau Bay (?), Rio Janeiro (?)." It is deposited in the Philadelphia Academy of Natural Sciences.

DISTRIBUTION: In addition to the above questioned localities, this species has been recorded by the "Siboga" from two stations in the East Indian region, namely: Station 16, in Plankton, from the south coast of Kangeang ($6^{\circ} 59' \text{ S.}$ — $115^{\circ} 24' 7'' \text{ E.}$); Station 136, Ternate, in 23 meters depth. The "Alva" specimens from Muntok add another East Indian record.

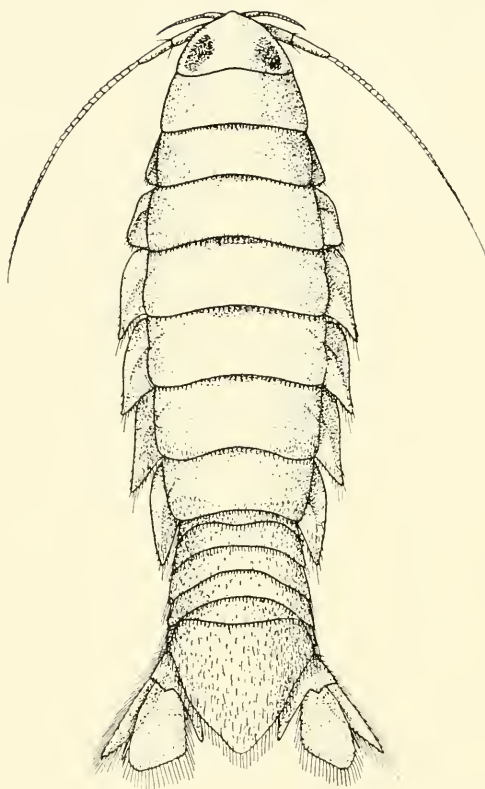
MATERIAL EXAMINED: Three small specimens, taken in jelly-fish, Muntok, Banka Island, Banka Straits, Dutch East Indies, November 5, 1931.

TECHNICAL DESCRIPTION: *Head*: This is two and one-third times as long as the first thoracic segment and about one-fourth wider across the posterior margin than long; roughly triangular with the median front a widely rounded process extending above and in advance of the antennal bases. Lateral margin notched slightly in advance of the eye and free beyond the antennal socket. Postlateral margins faintly trisinate. Eyes large, elongate, dorso-lateral in position; ocelli coarse; eyes separated from each other by a narrow, hourglass-shape space, which is slightly narrower at its widest point than the diameter of one eye. The first antennae are the thicker and consist of eight articles, extending almost to the postlateral angle of the first segment. The second antennae are distinctly slenderer, also composed of eight articles, with the first peduncular article thicker than those succeeding; articles two, three and four are longish, while articles five to seven, inclusive, are shorter and tapered distally, the eighth segment extending quite to the tip of the postlateral angle of the first thoracic segment. The second antennae exceed the length of the first antennae by the length of the eighth article of the second antennae.

Thorax: The first thoracic segment does not surround the head; is about two-fifths as long in the median line as the head; the second and third segments are subequal, each being slightly shorter than the first segment. The postlateral margins of the



Aegathoa macrophthalma Dana: A, profile of thoracic segments, showing epimera; B, dorsal view; C, profile of third leg; D, antennulae and antennae; all greatly enlarged.



Argathona confine Hale, $\times 4$.

first three segments are nearly straight. The fourth, fifth and sixth segments are subequal, each being about one-fourth shorter in the median line than the third segment; the seventh segment is very short in the median line, about one-half the length of the sixth segment. The epimera of the second to seventh segments, inclusive, are clearly defined, extending across the entire lateral margin of the related segment. On segments four to seven, inclusive, each, there is an oblique sulcus running inward. The postlateral margin of each epimera is rounded. There is an oblique carina running inward on each epimera, identical with those in Dana's figure, but less sharply defined in the present young specimens. All seven pairs of legs are prehensile; the first three pairs being directed forward and the remaining four pairs posteriorly. The third pair of legs have long, curved, hook-like dactyli. The seventh pair have the dactyli acute and much shorter than those of the third pair.

Abdomen: The abdomen is slightly narrower than the thorax; segments one, two and three are subequal, each is about as long as the seventh thoracic segment; segments four, five and six are each slightly shorter than the preceding segment and definitely narrower, their lateral portions being more appressed. The telson is about as wide proximally as long, with the distal margin widely rounded. The uropoda has a strong peduncle, both blades are longer than the telson; the inner blade is a little wider than the outer and has the distal margin unequally rounded, being somewhat truncate on the inner side; the outer, narrower blade is evenly rounded distally; both have the margins ciliated.

REFERENCES: *Aegathoa macrophthalma*, DANA, J. D., U. S. Explor. Exped., vol. XIII, Crust. pt. 1, 1852, p. 765; Atlas, 1855, pl. 50, fig. 12a-e.—NIERSTRASZ, H. F., "Siboga"-Expeditie, Livr. 114, Isopoda III, Monogr. 32C, Flabellifera II, 1931, p. 146, Leiden.

Family: CORALLANIDAE

Genus: ARGATHONA Stebbing

Argathona confine Hale

Plate 65

TYPE: A female taken at Albany Passage and deposited in the Australian Museum, Reg. No. 8205.

DISTRIBUTION: Queensland; known only from the type and the "Alva" specimen.

MATERIAL EXAMINED: One specimen, taken in coral, Ingram Island, Queensland, October 12, 1931.

TECHNICAL DESCRIPTION: Body narrowly suboval, three and three-fifths times as long as the greatest width, which occurs across the fifth and sixth thoracic segments; dorsal surface punctate. The posterior margins of the thoracic segments and epimera are finely setigerous; the abdominal segments are similarly setigerous; the telson is finely hirsute dorsally as well as the margins; the uropoda have the margins setigerous.

Head: This is two and one-half times as wide as the median length, with the frontal margin produced to a narrowed median, subtriangulate process that partly separates the antennae and nearly touches the frontal lamina. The eyes are large, dorsolateral in position, the greater portion of their surface being dorsal, extending from the posterior margin almost to the frontal margin and being well separated from each other by a space slightly narrower than the width of one eye. The first pair of antennae have the basal article dilated, nearly as wide as long, somewhat flattened and fitting closely to the head; the second article is about as long as the first, but slender, cylindrical; the flagellum is composed of nine slender, tapered articles. The second pair of antennae extend to about midway the length of the fourth thoracic segment. The first, second and third peduncular articles are short, stocky, subequal, considered together they are about equal to the fourth article, which is slender, cylindrical, a trifle shorter than the otherwise similar fifth article; the flagellum is almost twice as long as the peduncle and consists of twenty-eight articles and a terminal style. The frontal lamina is narrow, pentagonal, with the posterior margin incised. The clypeus is wide, V-shaped. The mandibles are elongate, the molar process represented by a weak blade; the palp is slender, with the first article scarcely half as long as the second; the third article is subequal to the first article. The first maxillae have the outer lobe terminating in a strong hook, which bears at the inner side of its base three curved spines, one being nearly half as long as the distal hook. The inner lobe is bluntly truncate distally. The second maxillae are shorter and smaller than the first with the apex simple. The maxillipeds have a five-jointed palp.

Thorax: The first segment is not produced around the head; the first, third, fourth, fifth, and sixth segments subequal in length, each being a trifle longer than the second segment, which is a line wider than the seventh segment. The epimera of the second, third, fourth, fifth and sixth segments extend across the entire lateral margin of the related segment, and those of the second and third segments have the outer postlateral angle rounded, while that of the second segment is more than that of the third segment, which is bluntly rounded; while the postlateral angles of the fourth, fifth, sixth and seventh segments are increasingly acute and produced, that of the last thoracic segment extending almost to the posterior margin of the second abdominal segment. Each epimera has an oblique carina extending across the dorsal surface, in addition to the carinate anterior margin there is also a light carina along the outer margins of the thoracic segments; on the first, second and third segments it extends across the entire segment, but on the fourth to seventh segments, inclusive, the carina runs obliquely inward.

Abdomen: The first abdominal segment is almost entirely concealed beneath the last thoracic segment; the second, third and fourth segments are subequal, punctate and hirsute; the fifth segment is slightly longer in the median line than the fourth segment, but is also narrower, having the postlateral parts concealed by the closely appressed fourth segment; the telson is an almost equilateral triangle, with the apex acute, the dorsal surface finely hirsute, the margins setose. The uropoda have the peduncle strong, produced obliquely, the inner distal angle acute, extending nearly half-way the length of the inner blade. The outer blade is narrowly lobate, wider proximally, tapered distally, a little shorter than the inner blade, with the margins crenulate and setose. The inner blade is nearly one and one-half times as wide as the outer, with the outer margin nearly straight, the inner margin shorter and decidedly more convex, obscurely truncated distally, giving the blade an asymmetrical contour; the margins are crenulate, setose. The rhipidura is longer than the telson; the shorter inner blade being about 1 mm. longer than the telson, while the outer blade is about 2 mm. longer. The first pair of pleopoda have the outer branch a little shorter and wider than the narrowly ovate inner blade, which has its sides subparallel.

Legs: The first three pairs of legs are prehensile, fairly strong,

the dactyli are unguiculate and do not have a small secondary hook at the base of the larger one. The ischium of the first pair of legs has two stout spines at the base of the distal end of the inner margin; the merus is beset with seven spines on the inner margin and one, smaller, at the apex of the outer margin; the carpus is short, with only one spine, and the propodus has four sharp spines on the inner margin; the dactyl is a strong, curved hook.

The fourth to seventh pairs of legs, inclusive, are ambulatory, similar, slender, beset with strong spines on the inner and distal margins of the third to sixth joints; these spines are simple, except some of those on the distal margin of the carpus, which are forked. The basis is the strongest joint of the leg; the ischium is half as long as the basis, slenderer; the merus is about two-thirds as long as the ischium, about equal to the carpus; the propodus is about equal to the carpus and slenderer; the dactyl is short, with a strong, curved, hook-like tip.

REMARKS: The "Alva" specimen, which is a male, differs from Mr. Hale's type, in that the first joint of the peduncle of the antennae is no longer than the second joint. The space between the eyes, at its narrowest point on the dorsal surface, is apparently less than that figured by Hale. The "Alva" specimen, a male, appears to be somewhat narrower than Hale's type, and has the epimeral plates more visible in a dorsal view; appearing somewhat as do those figured by Miss Richardson for *A. similis*. However, the "Alva" specimen conforms with *A. confine* in all other characters.

REFERENCES: *Argathona confine*, HALE, H. M., Trans. and Proc. Roy. Soc. S. Australia, vol. XLIX, p. 164, text fig. 17a-j, 1925.

Order: AMPHIPODA

Family: LYCAEIDAE

Genus: BRACHYSCELUS Bate

Brachyscelus crusculum Bate

Plate 66

TYPE: The locality of Mr. Bate's type is unknown. The specimen is in the collections of the British Museum of Natural History.

DISTRIBUTION: North Pacific Ocean, Lat. 24° 49', Long. 138° 34' E., surface (Stebbing); Atlantic Ocean, "Hirondelle" Stations



Brachyseelus eruseulum Bate, $\times 14$.

174, 254, 262, surface (Chevreux); off Canary Islands, 250 fathoms (Boone).

MATERIAL EXAMINED: Two specimens, taken in 250 fathoms, off Fuerte Ventura, Canary Islands, Atlantic Ocean. Port Cabras, bearing 270 true 7 miles distant, by the yacht "Alva."

TECHNICAL DESCRIPTION: The larger of the two "Alva" specimens is 25 millimeters long diameter, in the curved position characteristic of this genus. The head is typically large, covered on either side by the large eyes, which are separated dorsally by a narrow median strip; anteriorly the head is produced to a prominent median frontal "angle" or node, as in Dr. Stebbing's male specimen.

The upper antennae have the distal peduncular joint reduced, the flagellum with the proximal portion very long; the brush on the convex side faintly developed, the opposite margin with many longer setae; the second article small, but distinctly articulated; the third article is minute, conic, tapered.

The inferior antennae have the basal article, with the gland cone incompletely coalesced with the wall of the head; the third peduncular joint is long, slender, curved, distally dilated; the fourth joint is similar, slightly longer; the fifth joint is narrower, about as long as the third article; the flagellum has the first article shorter than the fifth, slenderer, reflexed upon itself; the distal article about two-fifths of the length of the preceding joint, curved, tapered distally.

The mandibles, first maxillae and maxillipeds are identical with those described and figured by Dr. Stebbing.

The first gnathopoda have the sideplates as figured (pl. 66), decidedly produced forward, with the upper front margin folded and the front apex rounded; the first joint is sinuous, deeply channelled anteriorly in both the proximal and distal ends and posteriorly forming a small "elbow" just below the sideplate; the wrist is large with the front apex much produced and finely serrate, with the chela-forming portion armed with seven primary teeth on the front margin and armed with eight primary teeth on the hinder margin, in addition to the apex and several secondary denticles; the distal half of the hind margin of the hand has eight teeth; the finger is about two-fifths of the length of the hand, slender, acuminate.

The second pair of gnathopoda have large branchial vesicles with numerous pockets, as do also the succeeding pairs of legs. The first joint is nearly straight, with the front margin of the outer surface convex inferiorly; the front of the wrist is not produced downwards, but stands out from the hand; the chela-forming portion is decidedly more produced than is true in the first pair; and is armed with nine primary teeth on the front margin and four primary teeth, besides the apex, on the hinder margin; the margin is almost continuously serrulate to these four teeth; the posterior margin of the hand has nine teeth; the dactyl is two-fifths of the length of the hand.

The first pair of legs have the sideplates wider on the lower portion than on the upper; the first joint is arched near the base; the second joint is small, bent, elbow-like, scarcely longer than wide; the third article is slightly wider but not so long as the fourth and with a distal rounded lobe on the anterior margin; the posterior margin is finely pectinate; the fourth joint is similar to the third, narrower, with coarser, pectinate teeth on the hind margin; the fifth joint is about one-fourth longer than the preceding one, slenderer, tapered distally, and with the posterior margin coarsely pectinate; the dactyl is quite small, its length less than twice the distal width of the propodus, and curved, acuminate.

The second pair of legs is similar to the first pair, but has the third, fourth and especially the fifth joints longer, with the pectination much reduced on the third and fourth joints.

The third pair of legs has the side plates with the anterior lobe nearly acute, the posterior one square; the first joint is oval with the posterior margin much more convex than the anterior, the anterior margin with ten to twelve fine serrate teeth; distally this margin is rather squarely produced beyond the convex posterior margin; the second joint is short, curved; the third joint is wide and longer than the fourth and has fine pectinations along most of the anterior margin; the fourth joint is also pectinate; the fifth joint is about one-third longer than the fourth, slenderer, and nearly smooth; the dactyl is slender, short, tapered.

The fourth pair of legs has the sideplates not so wide as those of the preceding pair; the first joint of the fourth legs has the same length as that of the third legs, but is very much wider, with the anterior margin finely pectinate on the lower part, distally very little produced beyond the second article; the pos-

terior lateral margin is widely rounded; the greatest width of this joint is across the upper median two-fifths; the third, fourth and fifth joints are similar to those of the third legs; the pectinate teeth of the anterior lateral margins being stronger on the fourth legs.

The fifth pair of legs has the sideplates squarish, a trifle wider than deep. The first joint is much smaller than that of the preceding leg, being only three-fifths as long; the width of the first joint is three-fourths of the length of the anterior margin; the posterior margin is very decidedly more convex than the anterior margin; the third, fourth, fifth and sixth joints are quite small, together being about equal to the width of the first article; the second joint is quite short; the third joint is much wider than the fourth, longer than the fourth and fifth, weakly pectinate on part of the anterior margin; the fourth article is a little longer and much wider than the fifth and also pectinate on the anterior margin; the dactyl is minute.

The telson is subequal in length to the coalesced fifth and sixth segments, nearly as wide as long, with the lateral margins convergent distally, forming an elongated arch, the apex of which is subacute.

The pleopoda have the peduncles stout, the branches well developed, multiarticulate; margins setose.

The uropoda have the peduncle of the first pair prismatic, slightly longer than the related outer branch, with the small distal lobe pectinate; these blades are also prismatic; the outer blade has the outer margin smooth, the inner margin finely pectinate; the inner blade is the longer and has the outer margin coarsely, and the inner margin finely, denticulate. The peduncles of the second pair are similar to the first but slightly shorter and with the inner apex more produced; in length they are subequal to that of the outer blades; both blades are widely lanceolate, the inner blade being much the wider and longer, but not quite so long as the inner blade of the first pair and having the inner margin distally sparingly, and the outer margin, finely denticulate on the distal portion. The outer blade is denticulate also on the distal portion. The third peduncle is much shorter than the related blades, being only about two-fifths as long and supporting the widest pair of blades, the inner of which is the larger; both blades widen considerably from the base, attaining their respective maxi-

mum widths below the center and thence narrow to an acute apex; the inner side of each blade being the more convex. The outer blade is the wider and has the inner margin denticulate; the inner blade has both margins denticulate distally.

REFERENCES: *Brachyscelus crusculum*, BATE, C. S., Ann. and Mag. Nat. Hist., ser. 3, vol. VIII, 1861, p. 7, pl. 2, figs. 1, 2; Brit. Mus. Nat. Hist. Catal. Amph. Crust., 1862, p. 333, pl. 53, figs. 2, 3.—STEBBING, T. R. R., Rept. Voy. H. M. S. "Challenger," Zool., vol. XIX, pt. 2, 1900, p. 1544, pl. 195.—CHEVREUX, ED., Res. Camp. Sci. Prince de Monaco, Fasc. XVI, Amphipodes, 1900, p. 153.

Thamyris crusculum, BOVALLIUS, C., Syst. List. Amphip. Hyper., Bihang till K. Svensk. Vetensk.-Akad. Handl., Bd. XI, art. no. 16, 1887, p. 31.

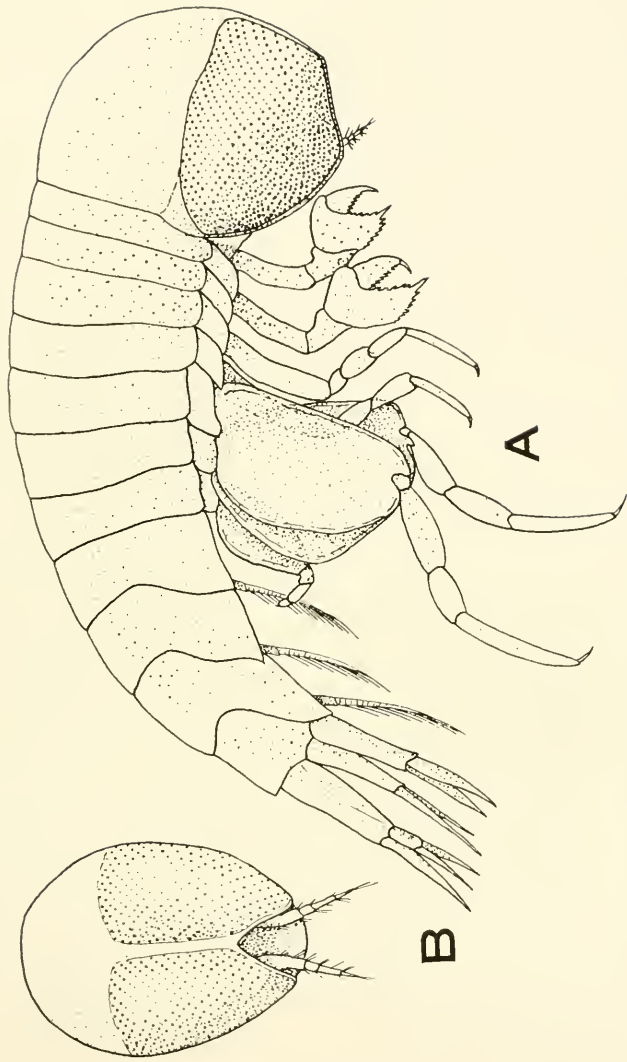
Brachyscelus stebbingi, new species

Plates 67 and 68

TYPE: One specimen, taken off Fuerte Ventura, Canary Islands, Puerto Cabras, bearing 270 true 7 miles distant, depth 250 fathoms, by the yacht "Alva."

DISTRIBUTION: Known only from the type.

TECHNICAL DESCRIPTION: *Head*: Typically large, smooth, convex, but differing from *B. crusculum* Bate, in that the present species lacks the median frontal lobe or "angle," the median dorsal strip that separates the eyes is anteriorly truncated, the strip bifurcating, forming a Δ -like narrower margin to the excavate mouth region. (See pl. 68, fig. B). The entire dorsal half of the head is smooth, the eyes being restricted to the lower six-tenths of each side and well separated dorsally by a median strip which bifurcates anteriorly, Δ -like, forming the upper margin to the truncate frontal region. Height of head, 3.5 mm., across the posterior margin; depth, taken across the upper border of eye, 2.5 mm.; width of median strip between the eyes 0.7 mm. The dorsal margin of the eye is almost straight, very faintly sinuate in the median region and curved downward at the postlateral angle, the lower frontal margins being evenly, widely convex and nearly contiguous with the margin of the head.



Brachysechus stebbingi, new species, type, $\times 13.5$; A, lateral view; B, frontal view of head.



Brachyseclus stebbingi, new species, type: A, superior antenna, $\times 18$; B, first gnathopod, $\times 14$; C, second gnathopod, $\times 14$; D, first leg, $\times 14$; E, second leg, $\times 14$; F, third leg, $\times 12$; G, fourth leg, $\times 14$; H, fifth leg, $\times 12$; I, caudal fan, $\times 12$. (Scale of enlargements approximated.)

The superior antennae have the distal peduncular article reduced, the visible portion being about as long as the articles of the flagellum and bearing a decided brush on the convex portion; the first and second articles of the flagellum are nearly subequal in length, together forming two-thirds of the length of the peduncular article; the first article is a little wider than the second and bears a couple of bristles at the distal border; the second article is nearly as slender as the conic, small distal third article, which is equally long and bears a tuft of bristles distally.

The inferior antennae are regrettably broken.

The mouthparts are very similar to those of *B. crusculum*.

The first gnathopods have the sideplates deeper than wide, nearly a parallelogram, with the lower anterolateral angle rounded and the postlateral angle more produced than the anterior one; the first joint of the gnathopod is short; the second joint is the longest of the entire series and is decidedly bent or arched; the third joint is less than half as long as the second, widened distally, with a rounded node at the anterior lateral angle distally; the fourth joint is greatly expanded, helmet-shaped, with the superior lateral margin convex, the chela-forming inferior apex greatly produced, the lower margin pectinate on the proximal two-fifths and armed with five acute teeth, besides the apical tooth; the anterior margin has nine teeth besides the apex; the propodus has six teeth and three or four denticles in series on the postlateral margin; the anterior lateral margin is convex; the dactyl is short, acuminate, its length about equal to three-tenths of the propodus and not produced as far as the apical tooth of the opposed carpus.

The second gnathopods have the sideplates much like those of the first pair of gnathopods; also the ischial and meral joints are similar, except that the rounded lobe on the anterior distal margin is larger in the second pair; the carpus is more widely expanded transversely and produced on the anterior distal border into a convex lobe that projects beyond the base of the propodus; the inferodistal angle is greatly produced, acute; the inferior lateral margin is pectinate on the proximal half and beyond this armed with four sharp teeth besides the apex; the distal margin bears ten or eleven smallish teeth in continuous series; the propodus is scarcely two-thirds as long as the opposed distal margin of the carpus; the superior lateral margin is quite convex;

the inferior lateral margin is armed along its entire length with ten acute teeth; the dactyl is small, acuminate; not as long as the median width of the propodus and not projecting as far as the apical tooth of the opposed carpus.

The first pair of legs has the sideplates a bit wider than the preceding pair; the third sideplates have the inferior margin semioval; the first joint is elongate, bent near the proximal end, about four times as long as wide; the second joint is short, elbow-like, scarcely as long as the width of the preceding joint; the third joint is clavate, about two-fifths as long as the first joint and wider distally; the fourth joint is a little shorter and not quite so thick as the third joint; the fifth joint, or propodus is three-fourths as long as the first joint, but very slender, with the inferior lateral margin pectinate; the dactyl is short, not quite twice the median width of the propodus, very acuminate.

The second pair of legs is quite similar to the first pair, but is slightly larger, in the ratio illustrated (Pl. 68, fig. E.), the propodus of the second pair being about one-fifth longer than the propodus of the first pair.

The third pair of legs has the sideplates nearly one and a half times as wide as deep, with the inferior margin sinuate, the anterior angle rounded, and the posterior angle produced and rounded. The first joint is greatly expanded, but with the anterior lateral margin very little convex, and produced at the anterior distal angle into a rounded lobe that extends beyond the posterior distal angle; the posterior lateral margin and distal angle are widely rounded; the length of this joint is equal to one and three-fifths times the greatest width; the second joint is short, not extending beyond the anterior distal angle of the preceding joint; the third joint is clavate, wider distally, its length equal to three-fourths of the median width of the first joint; the fourth joint is almost as long as the preceding joint, but less thick, convex; the propodus is slender, one and one-half times as long as the preceding article; the dactyl is one-sixth as long as the propodus, curved, acuminate. The anterior distal angle of the lateral margin of the first joint, also the anterior lateral margins of the third, fourth and fifth joints of the third legs, are finely pectinate.

The fourth pair of legs has the sideplate a nearly square parallelogram, with the posterior lateral margin slightly convex and the posterior angle acute; the first joint greatly expanded,

with the maximum width, which occurs slightly above the center, equal to seven-ninths of the length, with the anterior lateral margin broadly rounded proximally, sinuate, nearly straight for the greater portion of its length and broadly truncate, very little convex at the distal angle; the area finely pectinate, a small, tooth-like process distally above the base of the next joint, and beyond this and separate therefrom is the blunt, scarcely rounded posterior distal angle. The postlateral margin is very widely expanded, convex, attaining its greatest width just above the center; the second joint is short, not produced beyond the distal border of the first joint; the third joint is convex, with the anterior lateral margin pectinate; the fourth joint is shorter than the third but is similarly convex and has the anterior lateral margin pectinate; the propodus is as long as the two preceding joints considered together, slender, with the anterior margin pectinate; the dactyl is not quite one-fourth as long as the propodus, small, acuminate.

The fifth pair of legs is greatly reduced, concealed under the fourth pair. The first article of the fifth pair of legs is one-fourth longer than the remaining five joints considered together, and has the contour unequally oval, the anterior lateral margin but little expanded and the posterior lateral margin widely expanded, convex, attaining its greatest width, which is equal to three-fifths of the length, just above the center; the remaining five articles are small, having the ratio illustrated (Pl. 68, fig. H); the second joint is short, two-thirds as long as the third joint; the fourth joint is one-half as long as the third; the fifth joint is slenderer, shorter, tapered; the dactyl is minute, pointed.

The telson is subequal in length to the coalesced fifth and sixth segments and proximally is ten-thirteenths as wide as long, shield-shaped, with the lateral margins curved, convergent distally to an acute apex, which extends beyond the tip of the inner blade of the third pair of uropoda. (Pl. 68, fig. I).

The first pair (outermost) of uropoda have the peduncle prismatic, three-fourths as long as the coalesced fifth and sixth segments, or minutely longer than the related outer branch, which is very slender, distally narrowed, acuminate, with the outer margin nearly straight, the inner one more convex and crenulate; the inner blade is one-third wider than the outer blade and is narrowly lanceolate-acuminate, with the lateral margins about equal-

ly curved, the outer one coarsely and the inner one finely crenulate. The second pair of pleopoda have the peduncle similar to that of the first pair, but shorter, prismatic, with the inner distal apex more produced; the outer blade is shorter and less wide than the related inner blade, moderately lanceolate, with the inner margin crenulate; the inner blade is broadly lanceolate, with both margins curved and crenulate. The third, or most distal pair of uropoda, have the peduncle short, wide, less than half as long as the related outer blade; these two blades are decidedly the widest of the rhipidura; the outer blade being the smaller of the two and unequally developed, having its inner margin more widely expanded and rounded; the inner blade is longer and wider, expanded considerably from the base distally, with the two lateral margins convergent to an acute apex; both margins crenulated.

I have associated the name of Dr. T. R. R. Stebbing with this species. His invaluable knowledge of Crustacea was only excelled by his great generosity to younger students.

GEOGRAPHIC DISTRIBUTION
OF THE
SPECIES OF CRUSTACEA HEREIN REPORTED

1. Georgetown, Penang, Malay States:
Penaeopsis monoceros (Fabricius).
Parapenaeopsis sculptilis (Heller).
Palaemon (*Eupalaemon*) *carcinus* (Fabricius).
2. Singapore:
Thenus orientalis Leach.
Peneus indicus H. M. Edwards.
3. Near the Equator, southward of South Brother's Island,
south entrance of Durian Straits, Lat. $0^{\circ} 29' N.$ b. E., Long.
 $104^{\circ} 47' E.$:
Parapenaeopsis gracillima Nobili.
Acetes indicus H. M. Edwards.
Leptochela pellucida Boone.
Anilocra leptosoma Bleeker.
4. Banka Straits:
Latreutes mucronatus (Stimpson).
Aegathoa macrophthalma Dana.
5. Sourabaya, Java:
Cymothoa eremita (Bruennich).
6. Bali:
Pagurus dearmatus Henderson.
Galathea balica Boone.
Rhynchocinetes hendersoni Kemp.
Alpheus obesomanus Dana.
Alpheus, new species, (imperfect specimen).
Alpheus, new species, (imperfect specimen).
Palaemonella longirostris Borradaile.
Coralliocaris superba (Dana).
Saron marmoratus (Olivier).
Thor spinosus Boone.
7. Sumbawa:
Peneus monodon Fabricius.
Parapandalus serratifrons Borradaile.

8. Flores Strait, depth 140 fms.:
Plesionika binoculis (Bate).
Alpheus explorator Boone.
Pontophilus vanderbilti Boone.
Euphausia alvae Boone.
9. Solor Straits:
Munida militaris variety *andamanica* Alcock.
10. Queensland: Palm Islands:
Clibanarius corallinus (H. M. Edwards).
Galathea latirostris Dana.
Petrolisthes armatus (Gibbes).
Alpheus rapax Fabricius.
Coralliocaris graminea (Dana).
Saron marmoratus (Olivier).
Argathona confine Hale.
11. Queensland: Southport:
Pagurus deformis H. M. Edwards.
12. Noumea, New Caledonia:
Penaeopsis macleayi (Haswell).
Peneus merguiensis de Man.
Palaemon (*Eupalaemon*) *aemulus* Nobili, brackish stream.
13. Off New Hebrides, depth 250 fms.:
Euphausia consuelae Boone.
Thysanoessa gregaria G. O. Sars.
A separate report on the deepsea species of this station is in preparation.
14. Fiji Islands:
Calcinus elegans (H. M. Edwards).
Pagurus dearmatus Henderson.
Conchodytes biungulatus (Paulson).
15. Samoa:
Clibanarius corallinus (H. M. Edwards).
Calcinus herbstii de Man.
Galathea latirostris Dana.
Petrolisthes armatus (Gibbes).
Alpheus braschi Boone.
Periclimenes (*Ancylocaris*) *spiniferus* de Man.

16. Society Islands (Tahiti, Bora Bora and Raiatea Islands) :
 Calcinus elegans (H. M. Edwards).
 Pagurus deformis H. M. Edwards.
 Pagurus spinimanus H. M. Edwards.
 Aniculus aniculus (Fabricius).
 Coenobita clypeatus Latreille.
 Galathea latirostris Dana.
 Parribacus ursus-major (Herbst).
 Panulirus ornatus (Fabricius).
 Panulirus penicillatus (Olivier).
 Athanas gracilis Boone.
 Alpheus ventrosus H. M. Edwards.
 Alpheus obesomanus Dana.
 Palaemon (Eupalaemon) lar Fabricius; freshwater.
 Vanderbiltia rosamondae Boone.
 Harpilius lutescens Dana.
 Coralliocaris superba (Dana).
 Coralliocaris lamellirostris Stimpson.
 Coralliocaris tahitoei Boone.
 Gnathophyllum americanum Guerin de Menéville.
17. Anaho Bay, Nuka Hiva Island, Marquesas Islands; shallow water :
 Athanas djiboutensis Coutiere.
 Alpheus ventrosus H. M. Edwards.
 Harpilius lutescens Dana.
 Saron marmoratus (Olivier).
18. Off Marquesas Islands, depth 150 fms. :
 Stylocheiron longicorne G. O. Sars.
 A separate report on the deepsea species of this station is in preparation.
19. Galapagos Islands :
 Cymothoa exigua Schiodte and Meinert.
20. Atlantic Ocean : off Canary Islands, depth 250 fms. :
 Stylocheiron longicorne G. O. Sars.
 Brachyscelus crusculum Bate.
 Brachyscelus stebbingi Boone.
 A separate report on the remainder of the deepsea species of this station is in preparation.

PART II
ECHINODERMATA.

1

INTRODUCTION

The Echinoderm collection secured by the "Alva" world cruise, 1931, although numerically small, contains representatives of the five major groups of this phylum, of which only the Asteroidea and Echinoidea are included in the present report. The starfishes and sea-urchins obtained are all members of the littoral fauna of the Indo-Pacific region, exquisitely sculptured and magnificently colored sea-stars and urchins whose beauty is but an inconspicuous mosaic in the glorious coral reefs and tidal zone of the Palm Islands, Queensland, Durian Straits, Bali, New Caledonia, Fiji Archipelago, Marquesas Islands, Samoa, Society Islands, and the volcanic shores of Galapagos.

The starfishes include four species, three of which are from the Society Islands. The Tahitian series of *Culcita novae-guinae* Muller and Troschel consists of unusually fine specimens of this remarkable Asteroid. The *Acanthaster planci* from the Society Islands are also magnificent specimens. The tropicopolitan *Linckia guildingii* is the third Tahitian species. New distribution records for *L. laevigata* are also presented.

The sea-urchins are represented by ten species, for several of which new distribution is reported. The occurrence of typical *Euclidaris thouarsii* Valentin in Galapagos is verified. The specimen of *Phyllacanthus imperialis* (Lamarck) from New Caledonia is a remarkably fine one and apparently the first record of its occurrence here.

The ten species of Echinoidea are distributed as follows:

Euclidaris thouarsii (Valentin), Galapagos.

Prionocidaris baculosa annulifera (Lamarck), Seba Seba Bay, Durian Straits.

Phyllacanthus imperialis (Lamarck), Noumea, New Caledonia.

Echinothrix diadema (Linné), Society Islands.

Echinothrix calamaris (Pallas), Samoa.

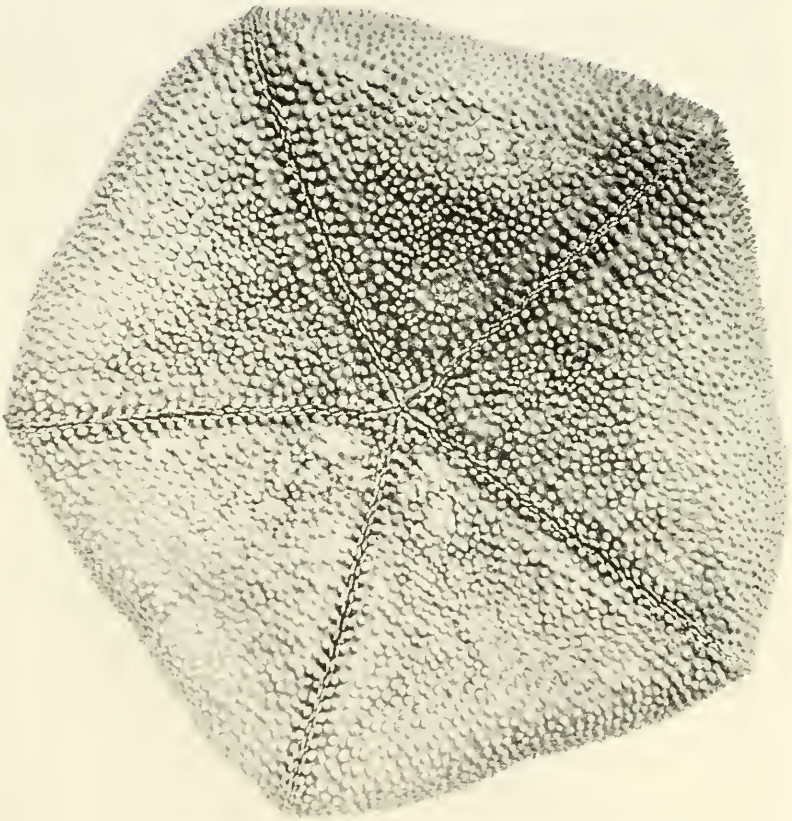
Temnopleurus toreumaticus (Klein), Durian Straits.

Tripneustes gratilla (Linné), Marquesas Islands and Society Islands.

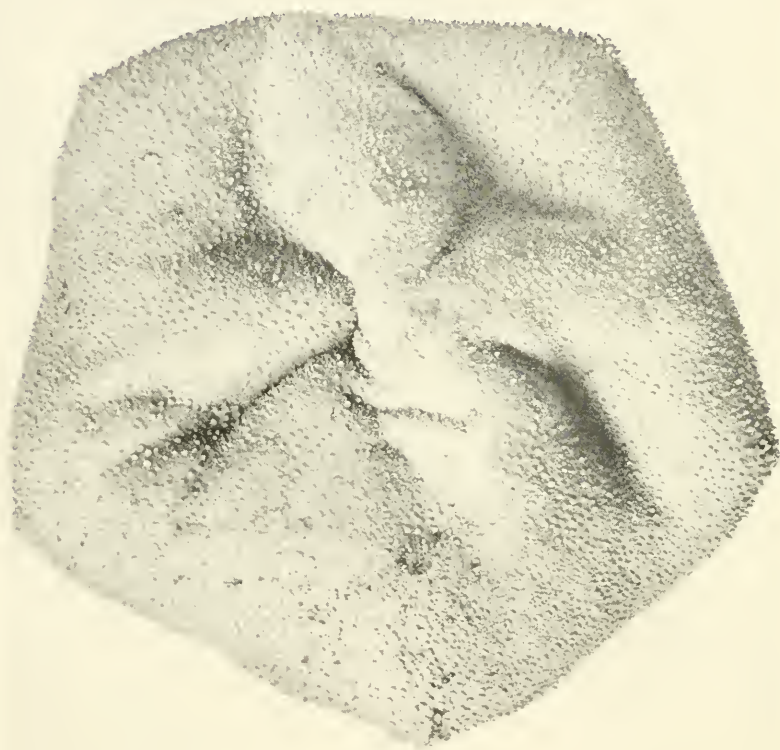
Parasalenia gratiosa (Agassiz), Samoa.

Echinometra mathaei de Blainville, Tahiti, Society Islands.

Heterocentrotus trigonarius (Lamarck), Tahiti, Society Islands.



Culcita novae-guinae Muller and Troschel, oral surface, about
one-half of natural size.



Culcita novae-guinae Muller and Troschel, aboral view,
about one-half of natural size.

ECHINODERMATA

Asteroidea

Order: PHANEROZONA

Suborder: Valvulosa

Family: OREASTERIDAE

Genus: CULCITA Agassiz

Culcita novae-guinae Muller and Troschel

Plates 69 and 70

TYPE: The type was collected in New Guinea by Salomon Muller and is deposited in the Leyden Museum.

DISTRIBUTION: This littoral species appears to have the center of its distribution in New Guinea, the Philippines and Moluccan seas and is also known northward as far as Japan, westward to Mauritius and eastward to the Society Islands. The following reliable records for it have been established: Japan: Ryukyu Archipelago (Goto); Kagoshima (Fisher); Philippine Islands: Zebu, Malanipa Island, 10 fathoms (Sladen); "Albatross" Station 5136, off Jolo Light, Jolo, 22 fathoms; Tictauan Island, east of Zamboanga, Mindanao, reef opposite Cebu, Cebu, Tataan, Simaluc Islands, Tawi-Tawi Islands, Sulu Archipelago, Sablayan Bay, Mindoro; Straits of San Bernadino, San Jacinto (Leipoldt, as *plana*); Eastern Archipelago (Sladen); Sunda Islands (Koehler); Amboina, Java, Padong, west coast of Sumatra, Mascarenes, New Guinea, Marshall Isles, Mascarenes; as *plana*, from Fiji Islands, Samoa (Hartlaub); Vavau, Tonga Islands, Ponape, Caroline Islands, reef, Papeete, Society Islands, these all from "Albatross" stations (Ludwig); Tahiti (Boone); Mauritius, as *plana* (Hartlaub).

MATERIAL EXAMINED: Three magnificent specimens, from the reefs, Venus Point, Tahiti, Society Islands, August 15, 1931, obtained by the "Alva."

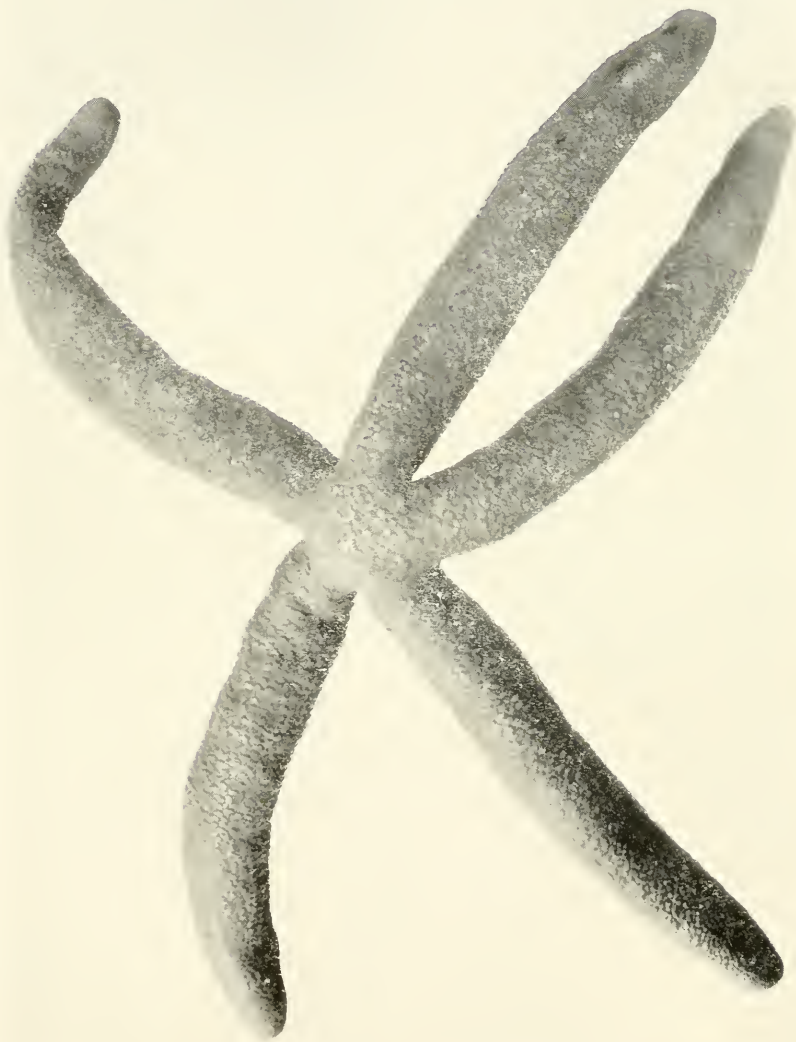
NOTES ON TAHITIAN SPECIMENS: The smallest of the "Alva" specimens, all three of which come from Tahiti, measures $R=95$ millimeters; form massive, pentagonal, with arcuate sides, the thickness of the specimen being approximately one-half of the R ; abactinal surface flattish, covered with a tough skin; papular

areas large, irregularly subcircular; the interspaces between the papular areas are exceedingly narrowed, and the short, pointed spines are quite as acuminate, although less numerous than as figured in Doderlein, pl. 19, fig. 3, *C. novae-guinae typica*, yet are more numerous than are figured by him in *plana*, pl. 19, fig. 1. However, the actinal surface of the present Tahitian specimens nearly agrees with his pl. 19, fig. 1, of *plana*. On the abactinal surface larger, stout conical tubercles are sparsely interspersed among the much finer tubercles, these larger spines becoming more abundant toward the circumference. The madreporite is small, oval, about 8 millimeters long diameter, with the surface finely porous and the margin circled by about ten stout, conical spines. The actinal surface has the large, conical tubercles irregularly spaced, those near the center being close together, while out toward the circumference these tubercles are more widely spaced and have the surface between covered with a fine uniform granulation.

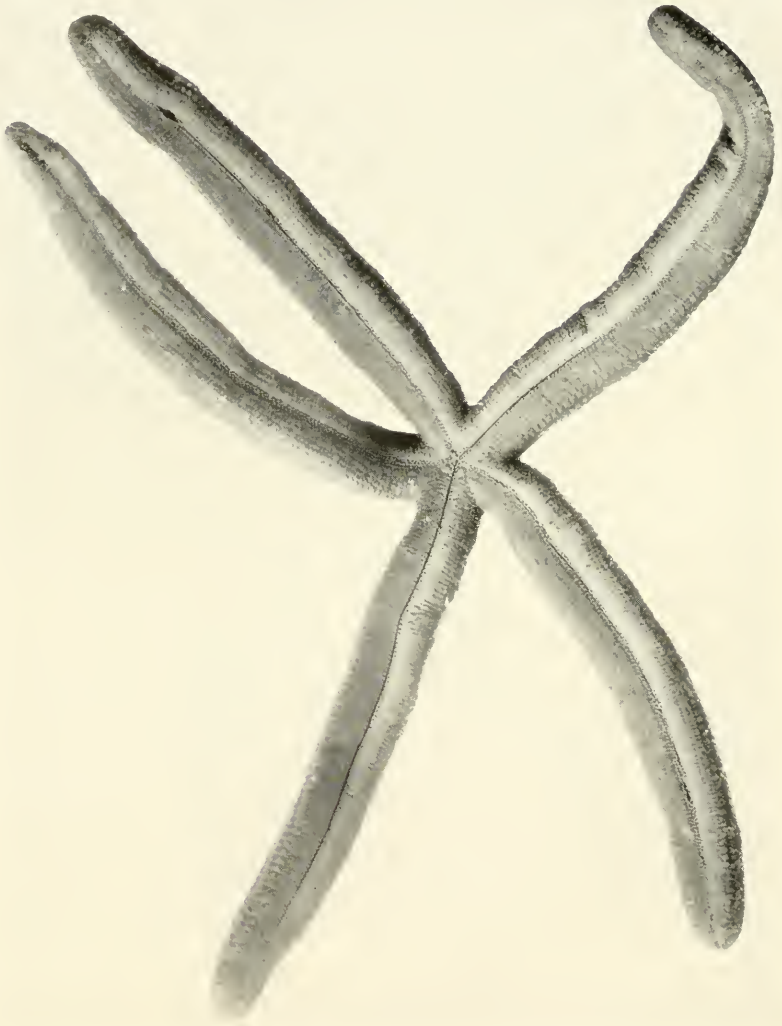
The second largest specimen, R=115 millimeters, is the more typical *novae-guinae* form on the abactinal surface, the spines being very numerous and close together; on the roundish papular area and very narrow interstices, between the papular areas, the spines are not so large, but are very pointed. They are also abundant on the sides of the starfish and very pointed here and also on the outer surface of the actinal surface. Toward the central portion of the actinal surface the larger tubercles are more rounded, like Doderlein's figure of *plana*, pl. 19. The furrow spines are coarse, 5 or 6 in number.

The largest starfish of the Tahitian series has an R of 135 millimeters and is the typical form of *novae-guinae*. The spines of the actinal surface are smallish, conical, very acuminate and closely set. The furrow spines are also very acuminate, 5 to 7. The large roundish or oval papular areas are crowded close together, the interspaces between being greatly reduced, very narrow and in many instances semireticulated, with numerous acute spines in series. There are also numerous fine, acuminate spines on the papular areas interspersed among the pores.

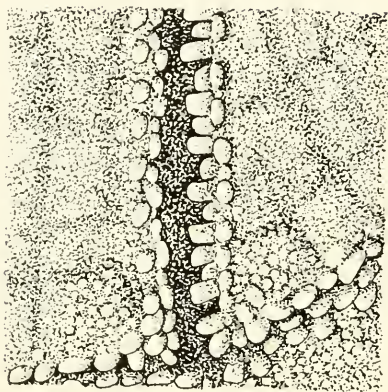
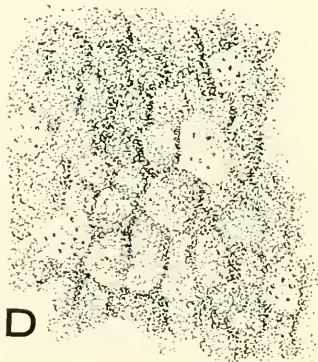
REFERENCES: *Culcita novae-guinae*, MULLER and TROSCHER, System der Asteriden, 1842, p. 38.—SLADEN, W. P., Rept. Voy. H. M. S. "Challenger" Zool., vol. III, 1889; Asteroidea, p.



Linckia guildingii Gray, aboral view, about one-half of natural size.



Linckia guildingii Cray, oral view, about one-half of natural size.

**A****B****C****D**

Linckia guildingii Gray: A, section of jaw angle; B, section showing teeth along the ambulacral furrow; C, madreporite; D, section of aboral surface; all greatly enlarged.

- 352.—HARTLAUB, C., Notes Leyden Mus., vol. XIV, no. 19, 1892, p. 77.—KOEHLER, R., Mem. Soc. Zool. France, t. VIII, 1892, p. 388.—SLUITER, C. P., Bidrag tot Dierkunde, Bd. XVII, 1895.—DODERLEIN, L., in Semon's Zool. Forschungsr., Bd. V, 1896, taf. XIX, fig. 1a, 2, 2a (Jena Denksch. VIII).—LUDWIG, H., Mem. Mus. Comp. Zool., vol. XXXII, art. 7, 1905, p. 156.—GOTO, S., Jrn. Coll. Sci. Imp. Univ. Tokio, vol. XXIX, art. 1, 1914, pp. 515-604, pl. 17, figs. 252-262 (Reviews literature and gives notes and excellent figures of the species).—FISHER, W. K., Bull. 100, U. S. Nat. Mus., 1919, p. 360.
- Culcita plana*, HARTLAUB, op. cit., p. 84.—LEIPOLDT, Asteroidea d. Vittor-Pisani Exped. Zeitschr. f. w. Zool., Bd. LIX, 1895, p. 637.

Family: OPHIDIASTERIDAE

Genus: LINCKIA Nardo

Linckia guildingii Gray

Plates 71, 72 and 73

TYPE: Gray's type came from St. Vincent, West Indies, and is deposited in the British Museum of Natural History.

DISTRIBUTION: This *Linckia* is tropicopolitan, being known in the Atlantic Ocean from the Bermudas, Bahamas, Florida, Cuba, Jamaica, St. Kitts, Tobago, and southward through the West Indies, Gulf of Mexico and Caribbean to the northern shore of South America at Bahia, Abrolhos Reefs, and eastward as far as the Cape Verde Islands and lower Guinea. In the Indo-Pacific it is known from the Red Sea, eastward through the Persian Gulf, Andaman Islands, Nicobars, New Caledonia, Fiji Islands, Tonga Islands, Samoan Islands, Tahiti and the Hawaiian Islands. So far it has not been recorded from the tropic west coast of North America, being replaced there by *Linckia columbiae* Gray.

MATERIAL EXAMINED: One specimen (photographed), from Venus Point Reef, Tahiti, Society Islands, August 15, 1931.

COLOUR: Dr. H. L. Clark, after extensive field research, reports that young specimens living in concealed situations are usually dull reddish, brownish, or purplish, variegated with darker tones. As the starfishes become larger there is a tendency for the

coloration to become uniform and somewhat lighter. Those remaining concealed tend to retain their purplish coloration, while those that change their habitat to exposed locations on the reefs and flats tend to become a uniform yellow-brown.

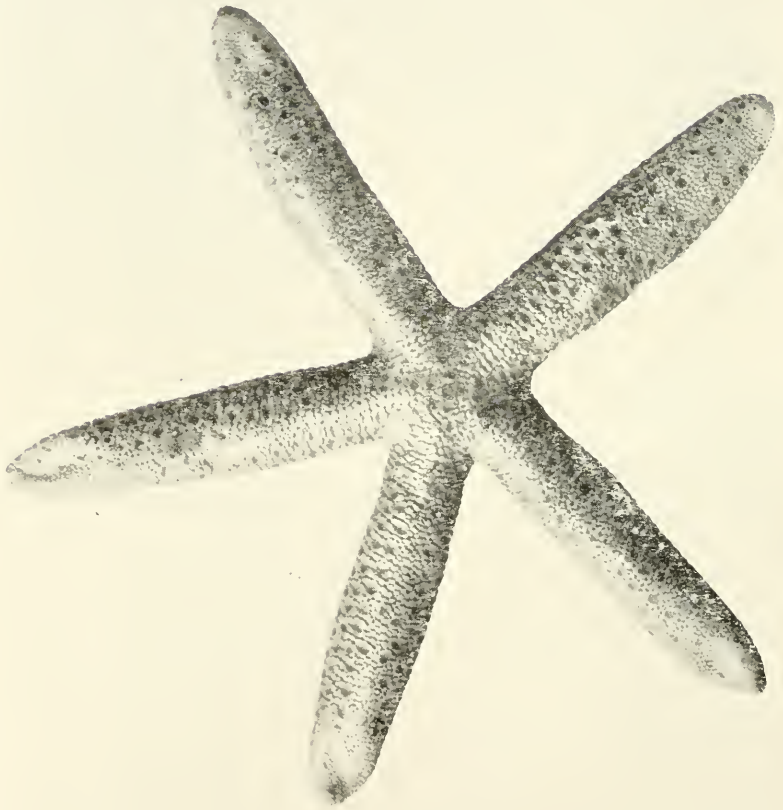
TECHNICAL DESCRIPTION: Stellate, rays slender, tapered distally, tips rounded; rays variable in number, due to autotomus division, normally 5 or 6, less frequently 4 to 9.

R=150 mm.; r= 20 mm. Abactinal surface with the plates small, numerous, closely set, with their edges frequently overlapping, usually with no connective ossicles, except small, lateral ones; plates irregularly polygonal, thick, moderately convex dorsally and externally densely covered with fine, close-set granules.

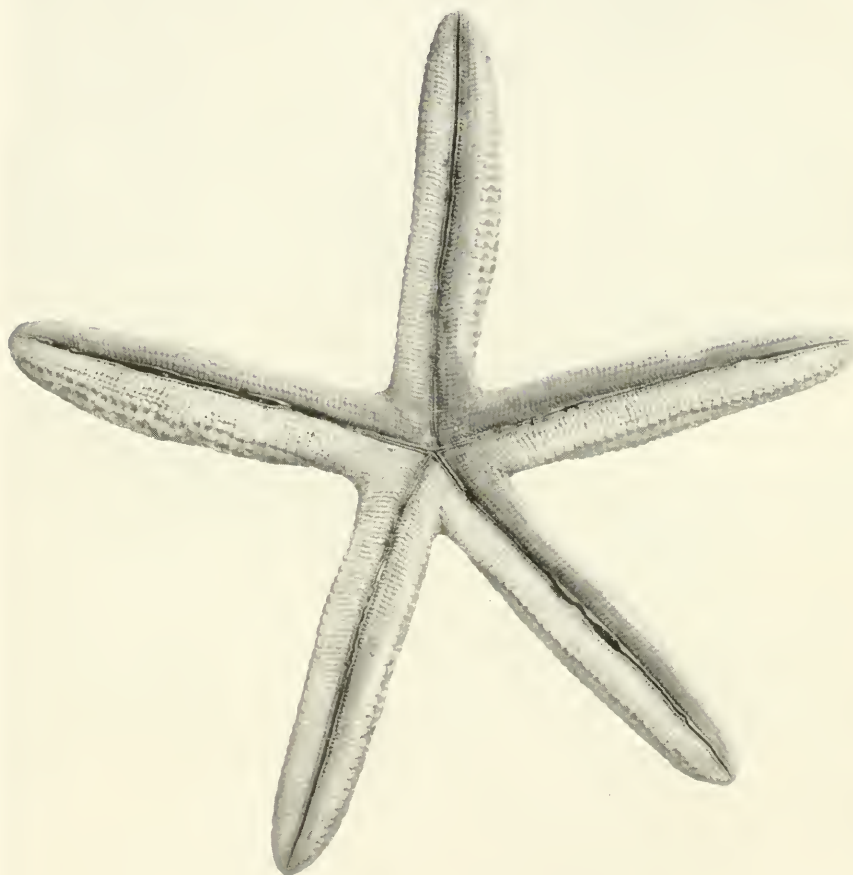
The papular areas are large, in series of 8 to 12 or more, with the median ones very irregular, obscure; the papulae small, numerous, 10 to 42; the pores are normally much smaller than the larger granules of adjacent plates. The marginal plates are arranged in two nearly equal rows and are larger and more quadrangular in shape than the abactinal plates. The interactinal plates are arranged in two long, regular rows and some shorter, smaller, squarish plates. The interradi al plates are small, arranged in triangular groups; these are covered and practically concealed by crowded, fine granules, similar to those on the abactinal plates. The adambulacral plates bear two rows of small, short spines and proximally on the adjacent series of interambulacral plates there is a third row of similar small spines, parallel to the outer row. These interactinal spines are of the same number and placed opposite to the outer series of interambulacral spines. The granulation of the actinal surface, which is like that of the abactinal surface, does not extend up into the ambulacral grooves; the furrow spines are adjacent to one another and are not separated by granules. (See pl. 73, fig. B.)

The single specimen, taken by the "Alva" at Venus Point Reef, Tahiti, is identical in structure with those from the West Indies and lower Caribbean examined by the writer.

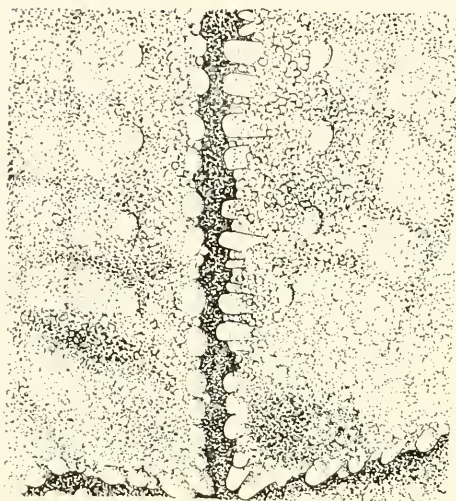
REFERENCES: *Linckia guildingii*, GRAY, J. E., Ann. Mag. Nat. Hist., ser. 1, vol. VI, 1840, p. 285.—AGASSIZ, A., Mem. Mus. Comp. Zool., vol. V, 1877, p. 105, pl. XIV, figs. 1-6.—FISHER, W. K., Bull. 100, vol. III, U. S. Nat. Mus., 1919, p. 401.—CLARK, H. L., Papers Dept. Marine Biol., Carnegie Inst., Washington, Publ. 214, 1921, p. 67.



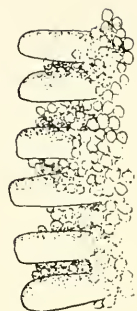
Linckia laevigata (Linné), aboral view, about two-thirds of natural size.



Linckia laevigata (Linné), oral view, about two-thirds of natural size.



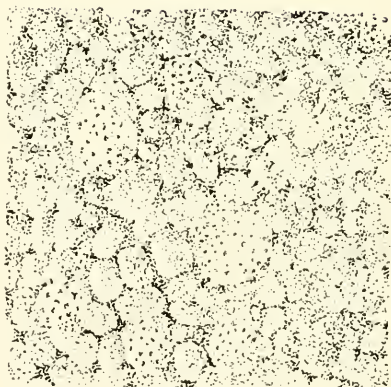
A



B



C



D

Linckia laevigata (Linné): A, section of jaw angle; B, section showing teeth along the ambulacral furrow; C, madreporite; D, section of aboral surface; all greatly enlarged.

Linckia pacifica, GRAY, op. cit., p. 285.

Ophidiaster ornithopus, MULLER and TROSCHER, Syst. der Asteroidea, 1842, p. 31.

Ophidiaster ehrenbergii, MULLER and TROSCHER, op. cit., p. 31.

Linckia nicobarica, LUTKEN, C., Vidensk. Meddel., 1871, p. 265.

Linckia ehrenbergii, DE LORIO, P., Mém. Soc. Phys. Hist. Nat. Geneve, t. XXIX, no. 4, 1885, p. 31, pl. 10, figs. 1-7a.

Linckia laevigata (Linné)

Plates 74, 75 and 76

TYPE: Linné's type came from the Indian Ocean and is deposited at Upsala.

DISTRIBUTION: This strikingly beautiful species has been reliably recorded from the Red Sea, southward on the East African coast at Zanzibar and Mozambique, and eastward from the Red Sea in the Persian Gulf, Madras, India, the Andaman Islands, Ceylon, Amboina, Halmaheira Islands, Flores Island, Timor, Batjan, Borneo, Philippine Islands, New Guinea, New Caledonia, Gilbert Islands, Marshall Islands, Fiji Archipelago, Samoan Islands, Solomon Islands, Caroline Islands, Society Islands, Guam and Hawaiian Archipelago. In the western Indian Ocean it has been found at Mauritius. Koehler reported it from the Aru Islands. Fisher had it from numerous stations in the "Albatross" survey of the Philippine seas. H. L. Clark found it at Erub and Mer, Torres Straits; Green Island, off Cairns, Queensland, and on the Great Barrier Reef southward to the Palm Islands (Lat. 19°). The Vanderbilt expedition secured it at Ingram Island, Queensland and adds two more new localities to its far-flung distribution, namely, Bali and Nuka Hiva Island, Marquesas Islands.

MATERIAL EXAMINED: Four specimens, taken at Suva, Vitu Levu Island, Fiji Islands, September 9, 1931. Three, from Temukus Roads, Bali, October 25, 1931. One from Pago-Pago, Samoa, September 2, 1931. Three specimens, from the reef, Ingram Island, Queensland, October 12, 1931. Two quite small specimens, from Anaho Bay, Nuka Hiva Island, Marquesas Islands, August 10, 1931.

COLOUR: The very young adults, up to an approximate radius of 35 to 40 millimeters, have a relatively inconspicuous colour pat-

tern, which on the abactinal surface is very variable, combination of grayish green on reddish brown, a pattern that blends inconspicuously into the environment sought by these young star-fishes in crannies and under stones. Their tube-feet are light yellow in younger forms, but a much deeper yellow in the older star-fishes, which are a brilliant cobalt blue dorsally. For colour plate of the juvenile and adult forms, consult H. L. Clark, 1921, pl. 9, fig. 1 and 2, and pl. 21, fig. 21; also Saville Kent, "The Great Barrier Reef of Australia," p. 358, pl. 12, fig. 8, 1893.

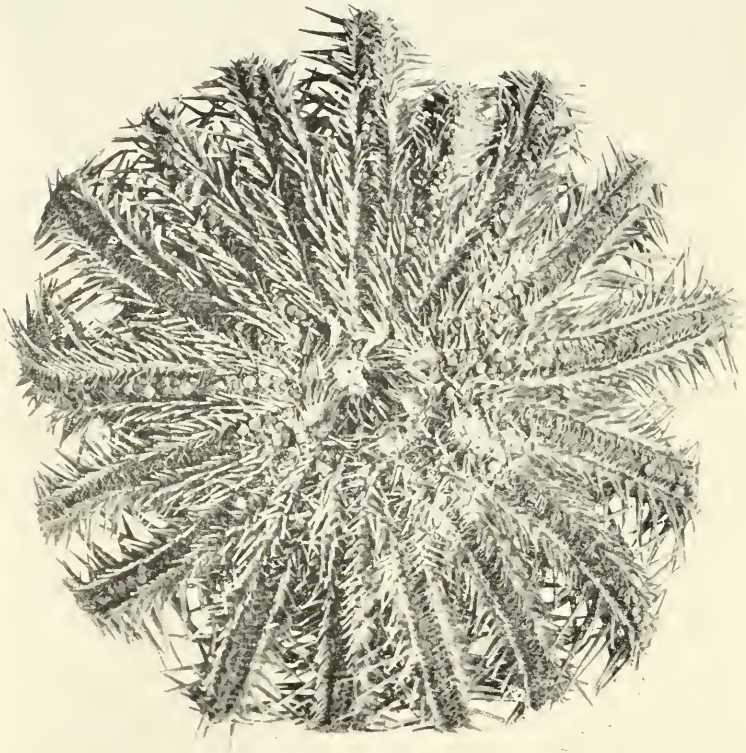
Dr. E. N. Harvey gives an excellent account of the chemistry of the blue pigmentation of this species in the Yearbook, Carnegie Institute, Washington, No. 13, 1915, pp. 204-205.

TECHNICAL DESCRIPTION: The "Alva" series of this species, one of which is figured, are all of medium size or very young. *Linckia laevigata* is seldom subject to autotomous division, consequently it is more regularly stellate than *L. guildingii*, being usually five-rayed, the arms being short, moderately stout, distally rounded rather bluntly. $R=80$ mm., $r=15$ mm., average width of arm 14 mm. Abactinal plates thick, frequently very convex, polygonal, close together, with the papular areas apparently larger than the plates, pores 3 to 6; with a median radial area in which the papular areas appear to be lacking. The entire body is covered by a coarse granulation on the actinal surface; these granulations extend upon the sides of the ambulacral grooves, in a vertical series of one to two fine granules wide, separating the furrow spines, as shown in pl. 76, fig. B. The jaw angle and jaw teeth are as shown in fig. A. There is normally one madreporic body in this species, of the pattern figured, pl. 76, fig. C. Rarely two to four madrepores per specimen have been recorded.

The "Alva" specimens, from five different archipelagoes, are typical of the wide distribution this species attains. The four specimens from Vitu Levu, Fiji Islands, one of which is figured on plates 74, 75 and 76, are of the small, stout form and measure:

		Median width	
	R	br.	of arm
A	85	16	20
B	90	21	18
C	88	18	19
D	98	20	20

All measurements are in millimeters.



Acanthaster planci (Linné), oral surface, about two-fifths of natural size.



Acanthaster planci (Linné), aboral surface, about two-fifths of natural size.

- REFERENCES: *Asterias laevis*, LINNÉ, C., Syst. Nat. ed. X, 1758, p. 662.
Linckia typus, NARDO, J. D., Oken's Isis, 1834, p. 717.
Linckia crassa, GRAY, J. E., Ann. Mag. Nat. Hist., ser. 1, vol. VI, 1840, p. 285.
Linckia brownii, GRAY, op. cit., p. 285.
Linckia miliaris, many authors, from 1866 to 1912.
Linckia laevis, LUTKEN, C., Vidensk. Meddel., 1871, p. 265.—
FISHER, W. K., Bull. 100, vol. III, U. S. Nat. Mus., 1919, p. 400.—CLARK, H. L., Publ. 214, Carnegie Inst., Washington, Papers Marine Biol. Labr., p. 64, pl. 9, figs. 1, 2; pl. 26, fig. 1.

Order: SPINULOSA

Suborder: Alvelata

Family: ACANTHASTERIDAE

Genus: ACANTHASTER Gervais

Acanthaster planci (Linné)

Plates 77 and 78

TYPE: Linnaeus quotes Columna's figure, which is of a specimen from Goa, Portuguese India.

DISTRIBUTION: This striking species has a very wide distribution, being known from the Red Sea eastward to the Philippine Islands, and northward to the Ryukyu Islands, Japan, and eastward from the Molucca Islands, Amboina, Vitu, Fiji Islands, Samoan Islands and Society Islands.

MATERIAL EXAMINED: One unusually fine specimen from Venus Point Reef, Tahiti, August 15, 1931. Another specimen, not quite so large, from Muller's Reef, Bora-Bora Island, Society Islands, August 24, 1931.

NOTES ON THE TAHITIAN SPECIMEN: Rays seventeen, sixteen of which are subequal, the seventeenth ray being smaller, about one-half as thick as the larger adjacent rays and scarcely two-thirds as long. Rays about 50 per centum free. $R=120$ mm., $r=55$ mm. Dr. Fisher has recorded larger specimens from Pangasinan Island, P. I., including one with $R=185$ mm. The abactinal surface of the disk and rays is beset with long, acicular spines, each of which is borne on a high coarse pedicel, which belongs to the cruciform

plate of the abactinal skeleton. These plates are rather widely spaced, forming a coarsely meshed skeleton. The actinal primary spines are skin encased, regularly, evenly granulated for practically their entire length. The primaries are 20 to 30 mm. long, including the pedicel, which measures from one-fourth to one-third of this total length. These primaries are longer and somewhat more numerous towards the circumference of the disk. Again about midway the length of the rays these spines average the greatest length to be found on the dorsal surface. The primaries of the center of the disk average 20 mm. long and those of the middle arm average 30 mm. long. The abactinal surface of the disk, the proximal half of the abactinal surface of the rays and two-thirds or more of the dorso-lateral surface of the rays, bear numerous secondary or young spinules from 1 to 4 mm. in height, each of which arises from a miniature pedicel. The papular pores are fine and closely grouped. There are five small, roundish, wartlike madreporic bodies present on the disk, four of which occur within a radius of one-half of its circumference. The abactinal pedicellariae are very characteristic, being very slender, with their jaws from three to six times longer than wide.

The actinal surface has the spines moderately coarse, rather regular, individual spines vary from entirely finely granulated to being partly finely granulated, with the remainder nearly or quite smooth. The furrow spines are normally three, of conspicuous size, acuminate, the central one usually being the longer. There is usually a short, stub-like spinelet present, at one or both ends of each furrow series; sometimes the adoral spinelet is replaced with a short, bluntish, moderately tapered, two-jawed pedicellaria. The greater percentage of the plates have, located on the furrow face of the plate, near the adoral margin of the plate, a rather conspicuous, slender, tapered, two-jawed pedicellaria, most frequently located so that the jaws are respectively dorsal and ventral. The subambulacral spines average about three to three and one-half adambulacral plates in length and have a rather regular size. Each spine is grooved on the outer side of its distal third or half. The actinal intermediate spines are similar to the subambulacral spines. The slenderer of these spines are usually less prominently grooved.

REFERENCES: *Asterias planci*, LINNÉ, C., Syst. Nat., ed. X, 1758, p. 823.—LINNÉ quotes *Columna*, *Phytobasanos*, pl. 33, fig.

- A.—VERRILL, A. E., Monogr. Harriman Alaska Series, Smiths. Inst., vol. XIV, 1914, p. 364; Ann. Mag. Nat. Hist., ser. 8, vol. XIV, 1914, p. 16.
- Asterias echinites*, ELLIS and SOLANDER, Nat. Hist. Zooph., 1876, pls. 60 to 62.
- Acanthaster echinus*, GERVAIS, Dict. Sci. Nat. Suppl. I, 1841, p. 474, 1841.
- Acanthaster planci*, VERRILL, A. E., op. cit., vol. XIV, 1914, p. 373.—FISHER, W. K., Bull. 100, vol. III, U. S. Nat. Mus., 1919, p. 441.
- Acanthaster echinites*, LUTKEN, C., Vidensk. Meddel., 1871, p. 292.—PERRIER, E., Arch. Zool. Expér., t. IV, 1875, p. 360.—DODERLEIN, L., Zool. Jahrb. Syst., 1889, Bd. III, 1889, p. 822; also in Semon's Zoologische Forschungsr. in Australien, Bd. V, text; Denks. Med. Naturw. Ges., Bd. VIII, 1894-1903, p. 320, 322; atlas, taf. 21, figs. 2-7, 1896.—SLADEN, W. P., Rept. Voy. H. M. S. "Challenger" Zool., Asteroidea, vol. XXX, 1889, p. 536, 537.—DE LORIOL, P., Revue Suisse Zool., t. I, 1893, p. 387.—LUDWIG, H., Mem. Mus. Comp. Zool., vol. XXXII, 1905, p. 215.—KOEHLER, R., Mem. Soc. Zool. France, t. VIII, 1895, p. 402—SLUITER, C. P., Bidrag Dierk. K. Zool. Gesellsch. Afl. 17, 1895, p. 63.—BELL, F. J., in Dr. Willey's Zool. Results on Material from N. Britain, N. Guinea, the Loyalty Isles and Elsewhere, pt. II, Echinoderms, 1899, p. 138; Fauna and Geogr. Maldives and Laccadive Arch., vol. I, pt. III, 1902, p. 226.

ECHINOIDEA

Order: CIDAROIDEA

Family. CIDARIDAE

Genus: EUCIDARIS Pomel

Eucidaris thouarsii (Valentin)

Plates 80 and 81 of Vol. IV

MATERIAL EXAMINED: A single, magnificent specimen, taken in Conway Bay, Galapagos Islands, by the "Alva."

DISCUSSION: This single specimen, taken by the "Alva," also those taken by the "Ara" in Galapagos, and those taken by the "Pawnee" in the Gulf of California are true *E. thouarsii*. Re-

examination of the entire series, in search of the varietal characters designated by Doderlein (1887) and Mortensen (1928) for *galapagensis*, failed to establish any evidence these characters are constant in the present specimens. Some of the Lower California specimens and some of the Galapagan specimens have unusually thick, club-shaped spines exclusively, while others have both very thick primaries and slender primaries on the same animal, and have also the typical interporiferous zone of *E. thouarsii*. The Conway Bay specimen of the "Alva" expedition has a fairly abundant series of large globiferous pedicellariae, which do possess a distinct limb on the stalk. Some of the West Mexican specimens also have the same type of pedicellariae. Curiously some of the West Mexican specimens, having typical *thouarsii* characters in other respects, possess large globiferous pedicellariae with no distinct limb on the stalk, such as is described for variety *galapagensis*.

REFERENCES: For full description of this species and early literature, see BOONE, L., Bull. Vanderbilt Mar. Mus., vol. IV, 1933, p. 126, pls. 80 and 81.

For discussion of variety *galapagensis*, consult: DODERLEIN, L., *Cidarid* (*Eucidaris*) *galapagensis*; DODERLEIN, L., Jap. Seeigel I, Cidaridae, 1887, p. 20, taf. IX, 3a-d, X, figs. 1-14.—MORTENSEN, TH., Monog. of Echinoidea, I. Cidaroida, 1928, p. 399, pls. 42, fig. 13, pl. 86, figs. 8-10.

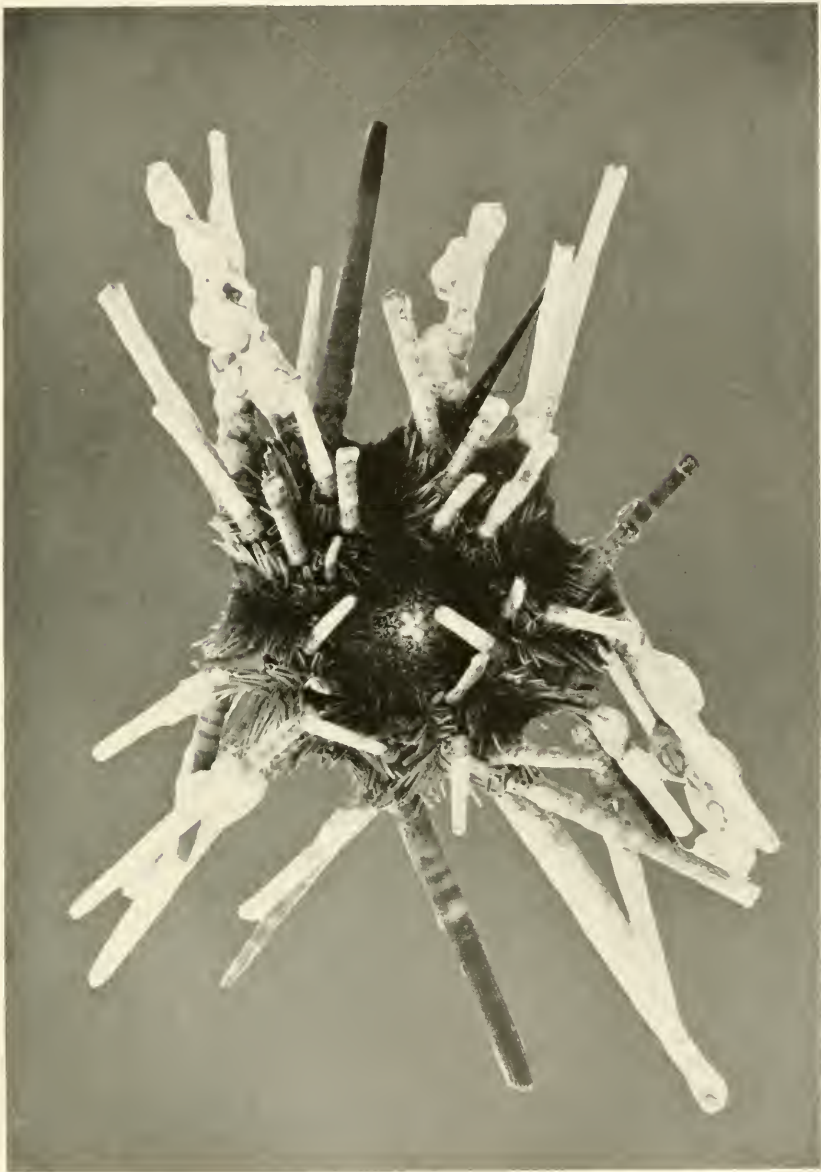
Genus: PRIONOCIDARIS A. Agassiz

Prionocidarid baculosa variety *annulifera* (Lamarck)

Plates 79 and 80

TYPE: Lamarck's type series came from the seas of New Holland and Kangaroo Island (Australia). His specimens are deposited in the Paris Museum.

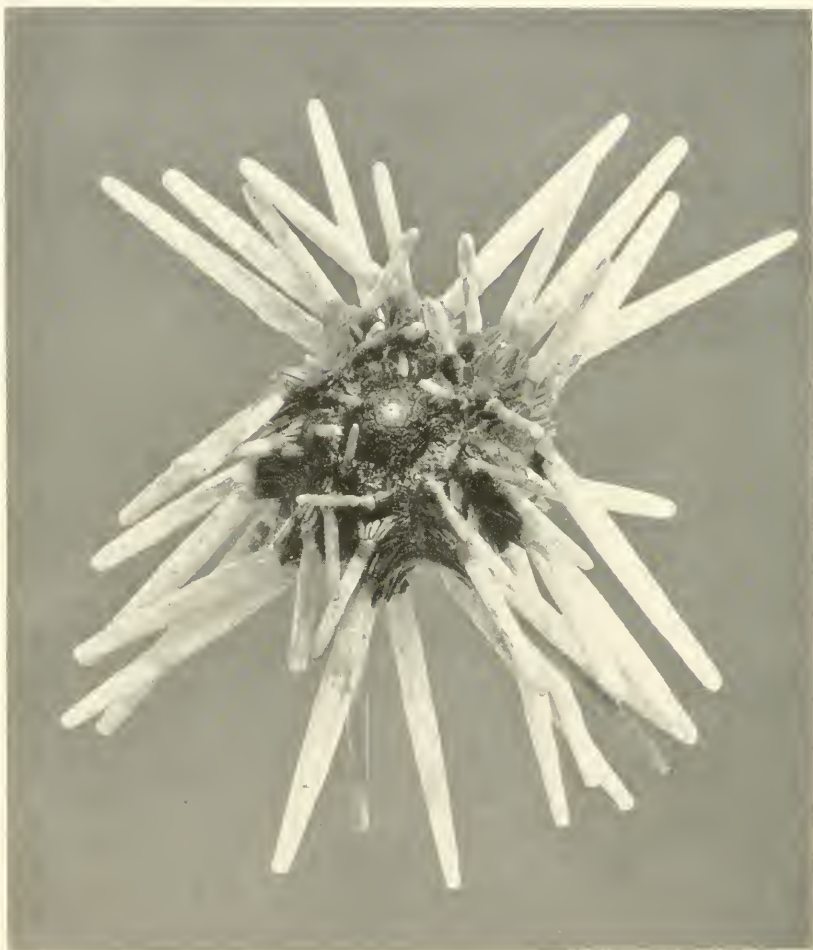
DISTRIBUTION: The typical form of *baculosa* is more abundant in the western Indian Ocean, while the variety *annulifera* has its center of distribution farther east in the Malay Archipelago. It has been reported from Java, the Philippine Islands, Moluccan Seas, northward to the Bonin Islands and Japan and westward to western New Guinea, Ceylon, western Australia from the Abrolhos Islands, and on the African coast from Mozambique. The "Alva" specimens establish a new record for it.



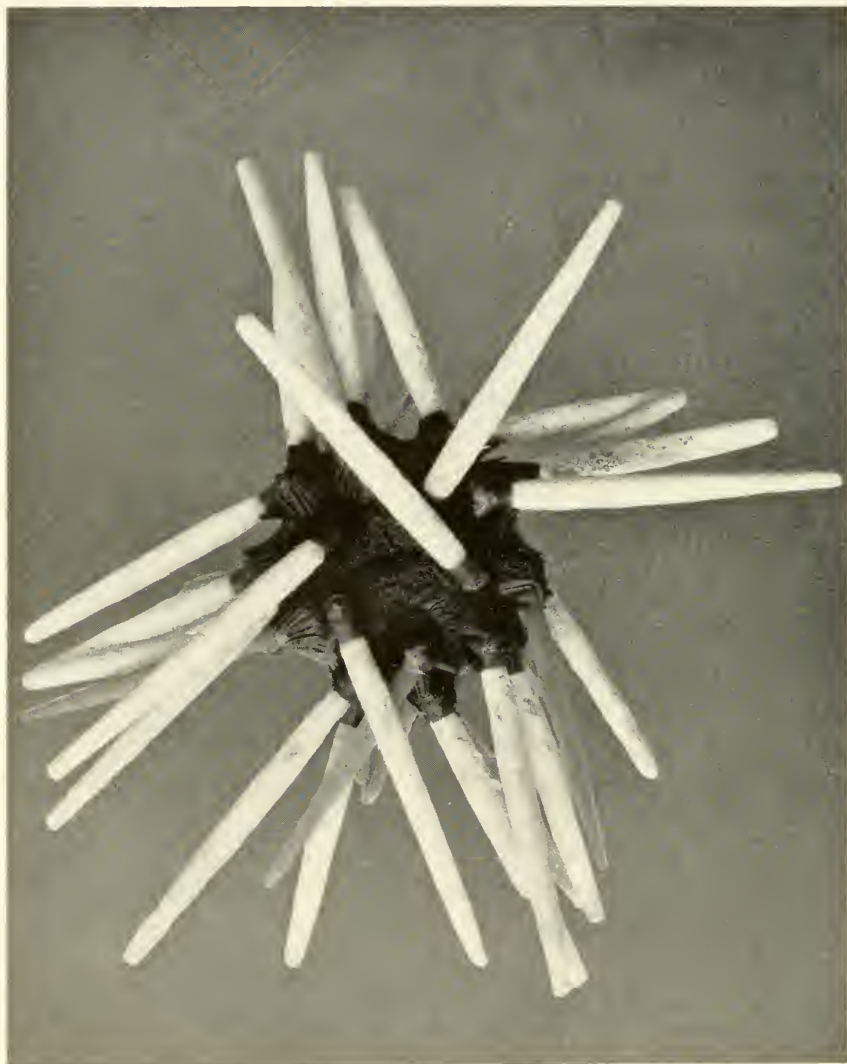
Prionocidaris baculosa variety *annulosa* Lamarck, oral surface, natural size.
This specimen is encrusted with calcareous algae, barnacles
and entwined with small Ophiurans.



Prionocidaris baculosa variety *annulifera* (Lamarck), aboral surface,
natural size.



Phyllacanthus imperialis (Lamarck), oral surface of urchin,
one-half of natural size.



Phyllacanthus imperialis (Lamarck), aboral surface of urchin, one-half of natural size.

MATERIAL EXAMINED: Two specimens from anchor chain, Seba-Seba Bay, South Brother's Island, Dutch East Indies, collected by the "Alva."

DISCUSSION: Dr. Mortensen (1928) presents critical diagnosis of both the typical and varietal forms of this species and concludes that they are both more or less distinct varieties of one highly polymorphous species, each form of which has an extensive range of individual variation. The variety *annulifera* is readily distinguished by its distinctive coloring of the primary and secondary spines, the primaries being conspicuously banded and much longer and slenderer than the typical *baculosa*; the collar of the primaries is also definitely longer in *annulosa*. The number of ambulacral plates corresponds to the interambulacral plates. The denuded test of *annulifera* is pearly white.

The "Alva" specimens are much encrusted with barnacles and Bryozoa and entwined with several specimens of an interesting ophiuran. The specimens have been preserved in alcohol for four years, so that the original color is gone, but the banded color pattern is retained.

REFERENCES: *Cidarites annulifera*, LAMARCK, J. B., Hist. Nat. Anim. sans Vert., 1816, t. III, p. 57.

Cidaris annulifera, DE LORIO, P., Mem. Soc. Sc. Neuchatel, t. V, 1873, p. 25, pl. 3.

Prionocidaris baculosa variety *annulifera*, MORTENSEN, TH., Monogr. Echinoidea I Cidaroida, 1928, p. 443, pl. 45, figs. 1, 2; pl. 46, pl. 51, fig. 2; pl. 53, figs. 4-8; pl. 73, figs. 14, 15; pl. 87, fig. 5 (with full diagnosis and extensive literature citations).

Genus: PHYLLACANTHUS Brandt

Phyllacanthus imperialis (Lamarck)

Plates 81 and 82

TYPE: Lamarck cited the Red Sea and the Mediterranean Sea as the type localities of his material and also referred to Seba's *Echinometra altera digitata*, Seba Mus. 3, tab. 13, fig. 3. Lamarck's specimens are in the Paris Museum.

DISTRIBUTION: This strikingly beautiful urchin is widely distributed all over the Indo-Pacific region from the Red Sea down

to Zanzibar and Madagascar, to Australia in the Torres Straits region and Queensland and the Tonga Islands, and northward to the Loo Choo Islands. Its bathymetrical occurrence is from littoral on the coral reefs down to 73 meters; this greatest depth having been recorded by the "Siboga."

MATERIAL EXAMINED: One unusually fine specimen taken at Noumea, New Caledonia, September 19, 1931, by the "Alva."

COLOUR: The living urchin has the secondary spines a rich dark purple and the primary spines somewhat lighter purple, sometimes with a faintly greenish tint, and not infrequently banded with yellowish white.

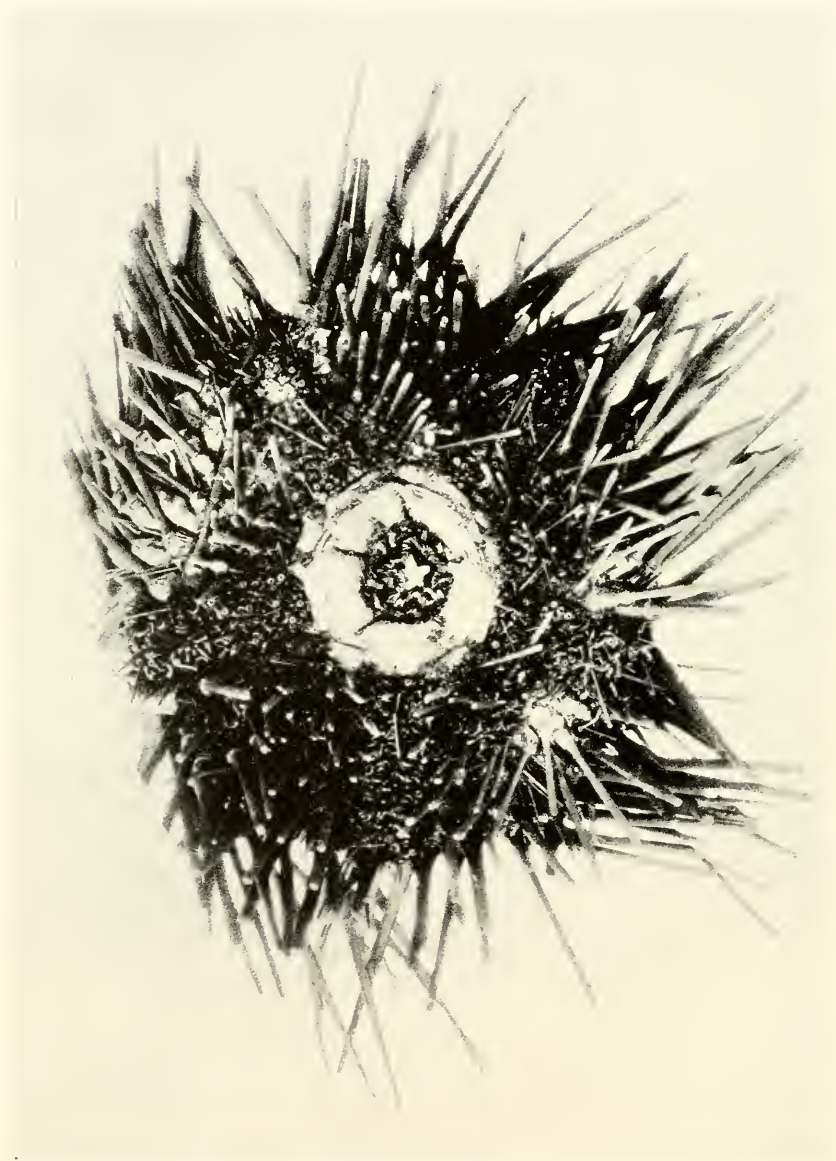
DISCUSSION: The "Alva" specimen from Noumea, New Caledonia, has the test with a width diameter of three and a quarter inches, height diameter of two and one-eighth inches, and the primaries from four to four and a half inches long, with the collar about one-quarter to five-eighths of an inch long. There are seven coronal plates present. The collar is unspotted, being a deep dark purple. The primary spines are very characteristic, quite stout, tapered distally and having very many close-set series of granules, forming longitudinal lines.

The "Alva" specimen is slightly larger than any of those examined by Dr. H. L. Clark in the British Museum collection and also is apparently the first definite record of this species from New Caledonia, which island, however, is well within the area of its distribution.

Dr. Mortensen has given us a characteristically thorough description of this species with an exhaustive bibliography (1928).

REFERENCES: *Cidarites imperialis*, LAMARCK, J. B., Hist. Nat. Anim. sans Vert., t. II, 1816, p. 54 (refers to Seba's pl. 13, fig. 3.—AGASSIZ, A., Rev. Echini, pt. III, 1873, pl. 1F, fig. 2.

Phyllacanthus imperialis, CLARK, H. L., Catal. Recent Sea-urchins, Brit. Mus., 1925, p. 10.—MORTENSEN, TH., Monogr. of Echinoidea, I Cidaroidea, 1928, p. 504, pl. 54, fig. 4; pl. 57, fig. 3; pl. 74, fig. 6; pl. 88, figs. 4-10.



Echinothrix diadema (Linné), oral surface of urchin, natural size.



Echinothrix diadema (Linné), aboral surface of urchin, natural size.

Order: **DIADEMATOIDA**

Suborder: **Aulodonta**

Family: **CENTRECHINIDAE**

Genus: **ECHINOTHRIX** Peters

Echinothrix diadema Linné

Plates 83 and 84

TYPES Linné's type came from the seas of India. It is deposited at Upsala.

DISTRIBUTION: This interesting urchin is also a widely distributed member of the littoral fauna of the Indo-Pacific, having been many times reliably reported from the Red Sea in the north to Mozambique, East Africa, in the south, eastward at Mer, Torres Straits, and the Hawaiian Islands, Society Islands and the Paumotu Archipelago.

MATERIAL EXAMINED: One large blackish specimen, from Tevatoa Reef, Raiatea Island, Society Islands, August 21, 1931. One very young specimen from the same locality.

DISCUSSION: The large specimen has a height of 50 mm., width of 90 mm., and length of 90 mm.; the small specimen has a height of 5 mm., width of 8 mm., and length of 9 mm. This young specimen has the primaries alternately banded with five bands of purplish brown, including the base and tip, with four alternating bands of lavenderish-creamy (preserved specimen). In this specimen the texture of the primaries appears more sharply etched on each separate groove than is true of the larger specimen.

The perplexing intergradation of the two species that comprise this genus has been ably discussed by Dr. H. L. Clark (1912).

The structure of the test and spines of the present species is well known from the excellent description of Agassiz and others. Mortensen (1904) has given a fine description of the pedicellariae.

Echinothrix diadema has a fairly constant specific character in the primary spines of the interambulacral region, these spines being rather thick in transverse section, with the diameter of the central cavity much less than half the diameter of the spine and with the spinules of the external surface arranged in close-set longitudinal series and *not in definite whorls*.

A second character, described in detail by Dr. Mortensen (1904), is to be found in the blades of the tridentate pedicellariae, which are widest near the center.

COLOUR: Very black in adults. For description of variations, see Clark (1912 and 1921).

REFERENCES: *Echinus diadema*, LINNÉ, Syst. Nat., e. X, 1758, p. 664.

Echinothrix turcarum, AGASSIZ, A., Mem. Mus. Comp. Zool., VII, 1873, pl. 3-a, fig. 3.—MORTENSEN, TH., K. Danske Vidensk. Selsk. Skrifter, 7R, Nat.-Math. Afd. I, 1904, p. 31.

Echinothrix diadema, LOVEN, S., Bihang, K. Svensk. Vet. Akad. Handl. Bd. XIII, afd. 4, No. 5, 1887, p. 137.—AGASSIZ, A., and CLARK, H. L., Mem. Mus. Comp. Zool., vol. XXXIV, 1908, no. 2, p. 16.—CLARK, H. L., Carnegie Inst., Washington, Publ. 214, 1921, p. 147.

Echinothrix calamaris (Pallas)

Plates 85 and 86

TYPE: Pallas' type, which Peters (1853) selected as the genotype of *Echinothrix*, was taken at Amboina, and is deposited in the Leyden Museum.

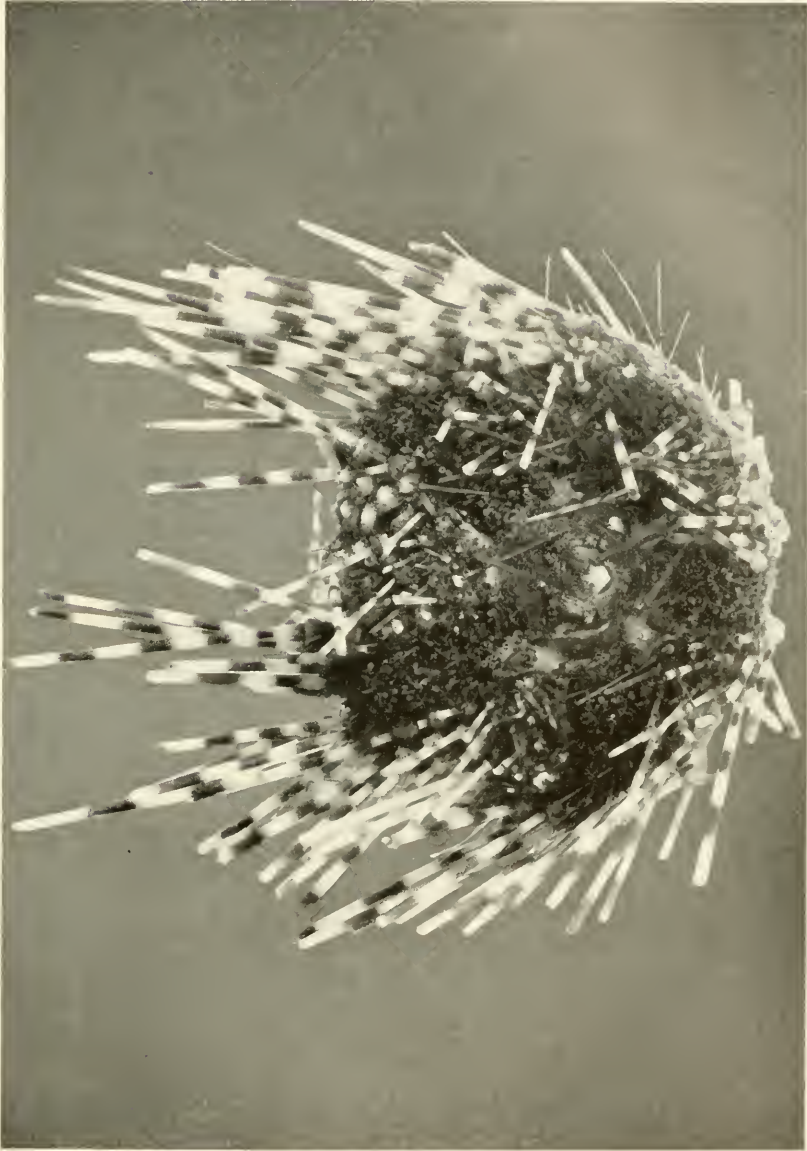
DISTRIBUTION: *E. calamaris* is also a widely distributed member of the Indo-Pacific littoral fauna, having about the same distribution as its congener, *E. diadema*.

MATERIAL EXAMINED: One large specimen Pago-Pago, Samoa, September 2, 1931.

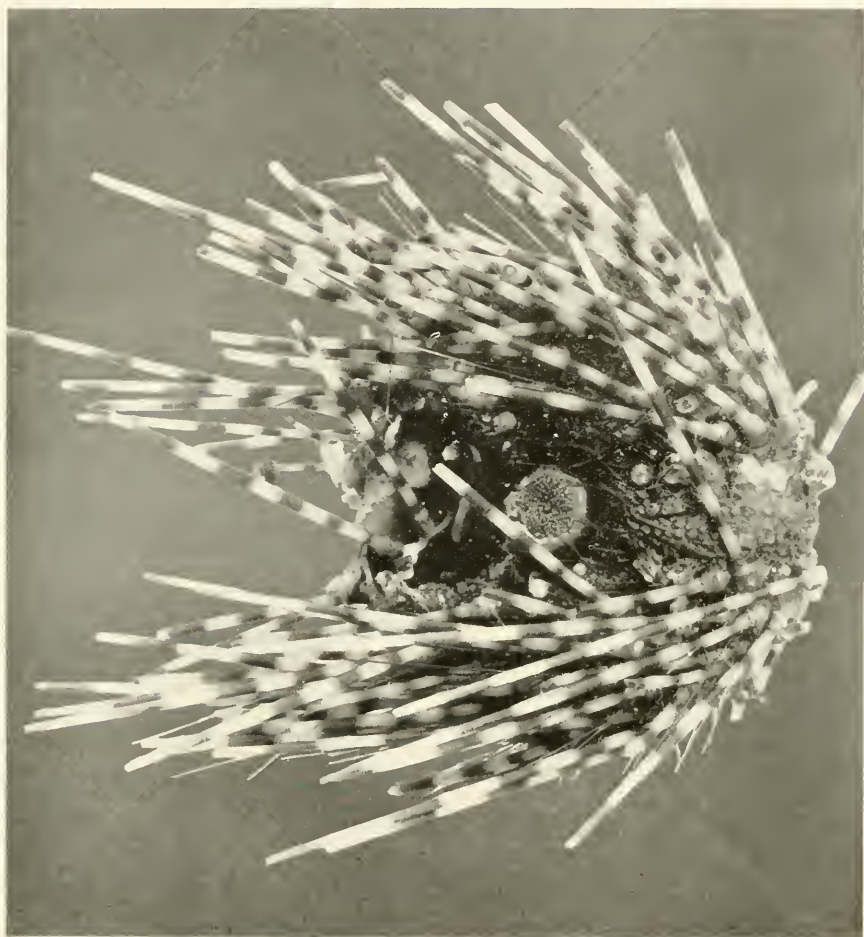
DISCUSSION: This specimen has a height diameter of 40 mm., width diameter of 82 mm., and length diameter of 85 mm. The primaries are alternately banded transversely with black and white, while the ambulacral primaries are partly banded with greenish yellow.

The diagnostic features of *E. calamaris* (Pallas) are to be found in the primary spines of the mid-region, which are of more fragile structure than those of *E. diadema*, having the diameter of the central cavity decidedly more than half of that of the spine; the external surface is ornamented with small spinules arranged in definite whorls.

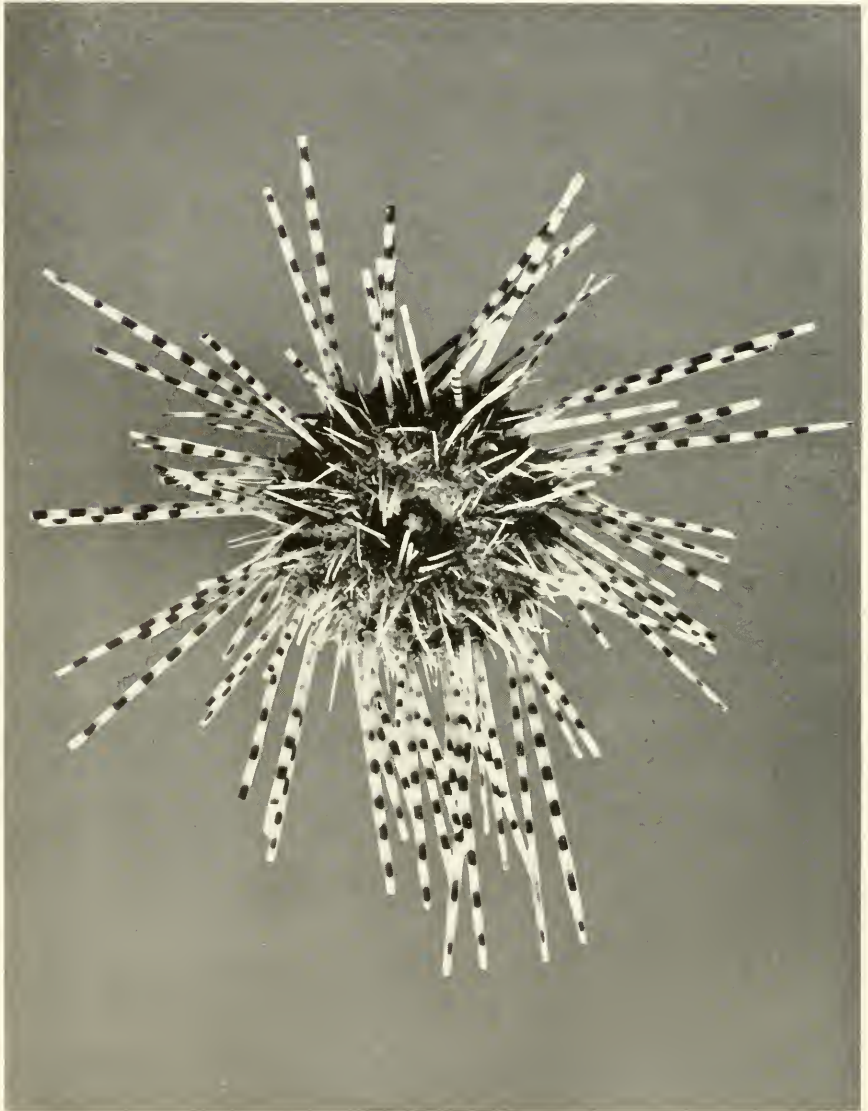
The tridentate pedicellariae have the blades of the valves widest at or near the distal apex.



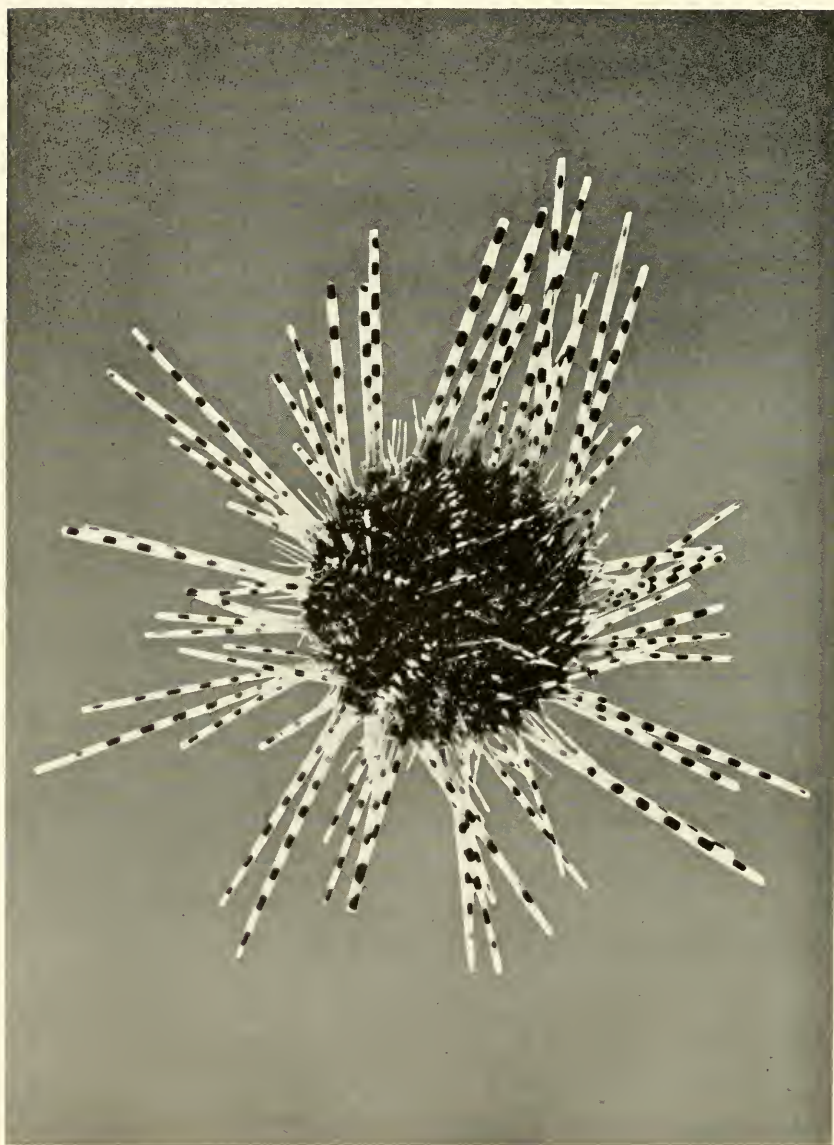
Echinothrix calamaris (Pallas), oral surface of urchin, natural size.



Echinothrix calamaris (Pallas), aboral surface, natural size.



Temnopleurus toreumaticus (Klein), oral surface, $\times 2$.



Temnopleurus toreumaticus (Klein), aboral surface, $\times 2$.

REFERENCES: *Echinus calamaris*, PALLAS, P., Spic. Zool., 1774, vol. I, fasc. X, p. 31.

Echinothrix calamaris, AGASSIZ, A., Rev. Echini, pt. I, 1873, p. 119 (Reviews early literature).—DE MEIJERE, J. C. H., Echinoidea "Siboga"-Expeditie, Monogr., 1904, p. 51 (Gives recent literature list).—MORTENSEN, TH., K. Danske Vidensk. Selsk. Skrift. Nat.-Math. 7 E R 1, 1904, p. 30, pl. 3, figs. 5, 13, 17, 30; pl. 4, fig. 7; pl. 5, figs. 3 and 11.—AGASSIZ, A., and CLARK, H. L., Mem. Mus. Comp. Zool., vol. 34, no. 2, 1908, p. 117.

Suborder: Camarodonta

Family: TEMNOPLEURIDAE

Genus: TEMNOPLEURUS Agassiz

Temnopleurus toreumaticus Klein

Plates 87 and 88

TYPE: The original record of this species was not available to the writer.

DISTRIBUTION: This species is widely distributed and somewhat unusually so, being known from the Arabian coast of the Red Sea (Koehler), eastward in the Persian Gulf, the Maldive Archipelago, Ceylon, China and southern Japan, at Kobe and Yokohama, the East Indies, the Arafura Sea, the Aru Islands (Doderlein); Prince of Wales Channel, Torres Straits; probably south to Queensland (Clark, 1912); Gulf of Siam, several localities (Mortensen); Durian Straits (Boone).

MATERIAL EXAMINED: One small specimen, from 15 fms., Durian Straits, south entrance, to the southward of South Brother's Island, near the Equator, Lat. $0^{\circ} 29' N.$ by E., Long. $104^{\circ} 47' E.$ October 22, 1931.

DISCUSSION: The single specimen of this species, taken by the "Alva" in Durian Straits, is about one-half of the size shown in plate 87, and conforms in all essentials to the excellent description of the species given by Agassiz (1872) and Doderlein (1885), as augmented by the much needed thorough analysis of the pedicellariae done by Mortensen (1900). The little urchin is exquisitely colored, even in the preserved specimen, the test being a rich wine-purple, and the primaries, both abactinal and actinal,

being alternately banded with purple and cream rings throughout their length. In common with other species of the genus, *T. toreumaticus* shows considerable diversity in the degree of sculpturing of the test, but may be distinguished from its congeners by the fact that the primary spines of the actinal region are always, and the other primaries usually, transversely banded. (See plates 87 and 88). In *toreumaticus* the ocular plates are excluded from the periproct.

REFERENCES: *Cidaris toreumaticus*, KLEIN, *Naturalis dispositio Echinodermata*, 1734, p. 17, pl. 10, fig. E.

Temnopleurus toreumaticus, AGASSIZ, L., and DE SOR, E., *Ann. Sci. Nat.*, ser. 2, t. VI, 1846, p. 360.—AGASSIZ, A., *Rev. of Ech.*, 1872, pp. 166 and 463, pl. 8a, fig. 45 (includes review of literature).—MORTENSEN, TH., *K. Danske Vidensk. Selsk. Skrift. Math-Naturg.*, 1904, 7 E R I, 1904, p. 58, pl. 6, figs. 8, 14, 22 and 49; pl. 7, figs. 7 and 28.—CLARK, H. L., *Mem. Mus. Comp. Zool.*, vol. 34, 1912, p. 312.

Family: ECHINIDAE

Genus: TRIPNEUSTES L. Agassiz

Tripneustes gratilla (Linné)

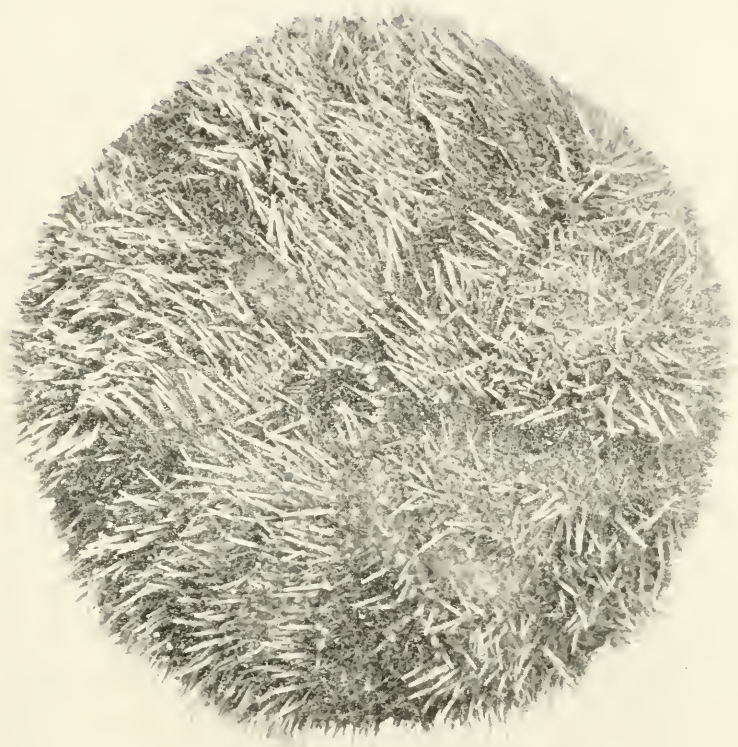
Plates 89 and 90

TYPES Linné's type came from the Indian Ocean; originally was in the Museum Ludovicae Ulricaе, but is no longer extant (Loven).

DISTRIBUTION: This conspicuous, edible sea-urchin is very abundant in the tidal zone of a wide area of the Indo-Pacific, having been repeatedly reported in the African region from the Red Sea in the north to Mozambique in the south, and eastward in the various island groups to the Hawaiian Islands in the north and the Paumotu Islands in the south, and also at Clarion Island, about three hundred miles west of Mexico. At Mer, Murray Islands, Dr. H. L. Clark found it abundant, at Green Island, Queensland, only one specimen was recorded; at Port Jackson, Mr. Whitelegge found it very rare, this locality being considered the southern limit of its range in Australia, while on the west Australian coast it is found down to Shark's Bay.



Tripneustes gratilla (Linné), oral surface, natural size.



Tripneustes gratilla (Linné), aboral surface, natural size.

MATERIAL EXAMINED: One large specimen, taken at Anaho Bay, Nuka Hiva Island, Marquesas Islands, August 10, 1931, by the "Alva." Another large specimen, taken on Muller's Reef, Bora-Bora Island, Society Islands, August 24, 1931.

COLOUR: Dr. H. L. Clark has given an exquisite colour plate of this species (1921, pl. 17, fig. 6). He reports that the colour of this echinoid is striking and variable, the more usual form having the test a dark, rich blue-purple, the spines white with the pedicels also white but part black. In many of the specimens he examined at Torres Straits, the spines were tipped with orange, frequently were entirely orange, some few had the spines entirely white, as appears to be the case with the specimen from Marquesas Islands and that from the Society Islands.

DISCUSSION: Lovén's splendid account of this Linnaean species (1887), and Agassiz's description and illustrations of it (1872), form the standard references for this well known urchin.

The "Alva" specimens are both quite large, typical forms, in excellent state of preservation. The one from Anaho Bay, Nuka Hiva Island, apparently establishes the first record of this species from the Marquesas, this specimen having a width diameter of 130 mm., an unusually large record.

It is interesting to recall that the type of this species, which came from the Indian Ocean, was once an item in the cabinet of Queen Louisa Ulrica, a younger sister of Frederic of Prussia, who married Adolphus Frederic of Holstein-Gottorp (1852) and with him succeeded to the throne of Sweden. A great portion of her collections of natural history specimens was obtained by purchase from Holland and her cabinet was Linnaeus' source for much of his work on Invertebrata, made possible by Her Majesty's patronage.

REFERENCES: *Echinus gratilla*, LINNÉ, Syst. Nat., 1758, ed. X, p. 664.

Triploneustes gratilla, LOVEN, S., Bihang K. Svensk. Vet. Akad. Handl., Bd. XIII, afd. 4, no. 5, 1887, p. 77 (with exhaustive notes on the Linnean type and early history of the species; also extensive literature references).

Hipponoe variegata, AGASSIZ, A., Mem. Mus. Comp. Zool., Rev. Ech., pt. I, 1872, p. 135; M. C. Z. VII, pt. III, 1873, p. 501, pl. 4B, figs. 5-6; pl. 25, figs. 6-7 (synonymy and description, illustrations).

Family: ECHINOMETRIDAE

Genus: PARASALENIA A. Agassiz

Parasalenia gratiosa A. Agassiz

Plates 91 and 92

TYPE: Prof. Agassiz's type was collected at Kingsmills and Society Islands and is deposited in the Museum of Comparative Zoology of Harvard University.

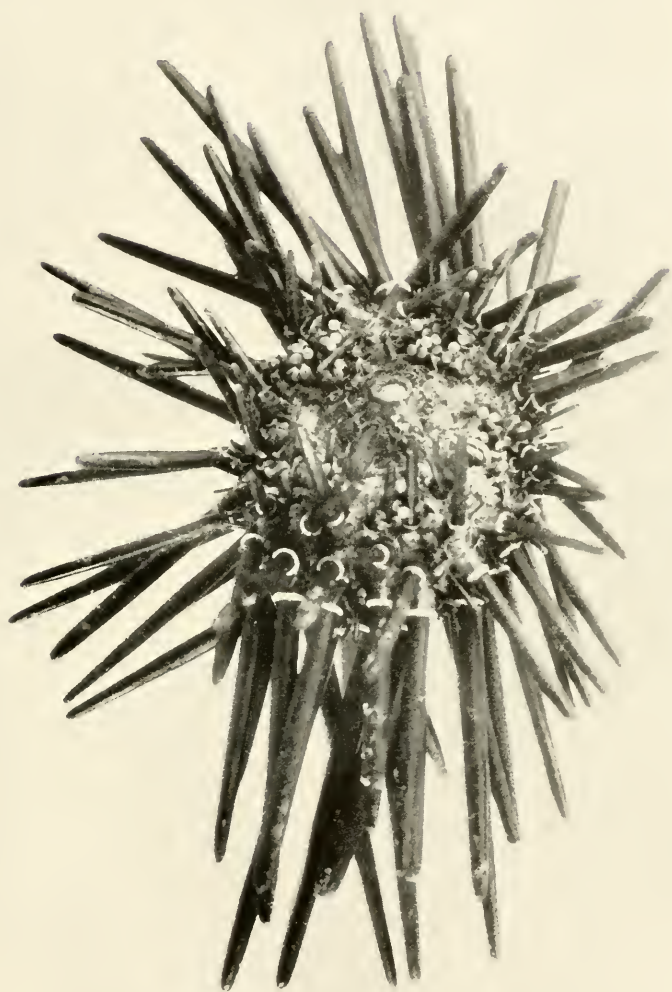
DISTRIBUTION: This exquisite small urchin has a wide distribution in the littoral fauna of the Indo-Pacific, being reliably known from the Red Sea (Mortensen) down to Zanzibar on the east African coast, through the Indian Ocean, at the Chagos Archipelago and Maldives and north to Japan, southward in the Gulf of Siam, the New Hebrides, New Caledonia, the Dutch East Indies (de Meijere), the Torres Straits and Queensland (Clark), and eastward to the Paumotu Islands and Samoan Archipelago.

MATERIAL EXAMINED: Four specimens, taken at Pago-Pago, Samoa, September 2, 1931, by the "Alva."

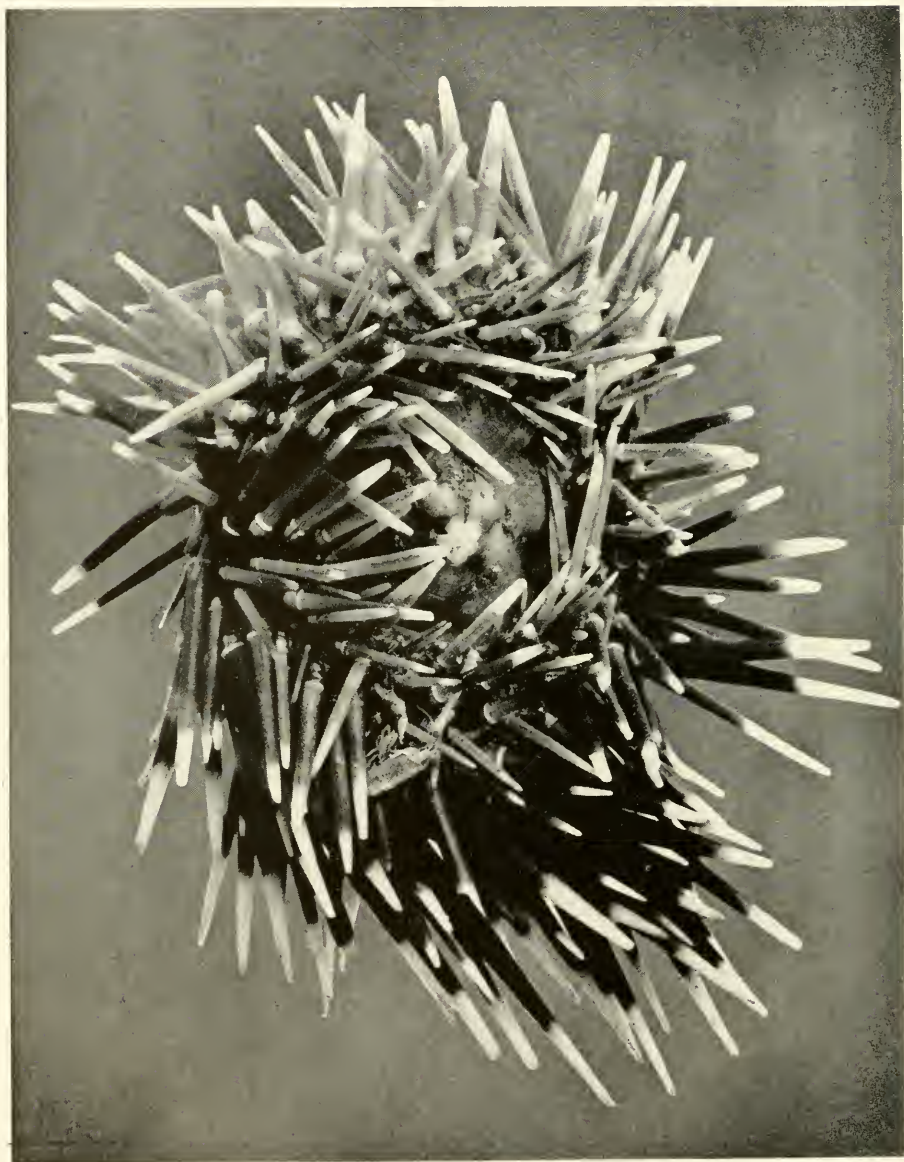
TECHNICAL DESCRIPTION: One of the "Alva" specimens has the long diameter 23 mm., and the short diameter 20 mm. The test is elliptical in contour, wider than high. The largest of the "Alva" specimens has the long diameter 23 mm., the short diameter 20 mm.; the general form of the test being like that of *Echinometra*, except that the periproct is composed of only four anal plates and is moderately large with the long diameter equal to about one-third of that of the abactinal system. The abactinal system is elevated. The ambulacral and interambulacral spaces have the tubercles arranged in two vertical rows, those of the ambulacral areas being closely crowded. The pores are arranged in pairs, forming an irregular vertical series. The genital and ocular plates are smooth; the genital plates having one or more well developed tubercles. The primaries are moderately long, gradually tapered, the longest ones being equal to or slightly exceeding the long axis of the test. In life the coloration of these spines is very distinctive, the primaries being very dark, purplish black, with the milled ring of each primary pure white. The secondary spines are quite small and not very abundant. In the very young specimens of this species the primaries are said to be more reddish and more or less regularly banded.



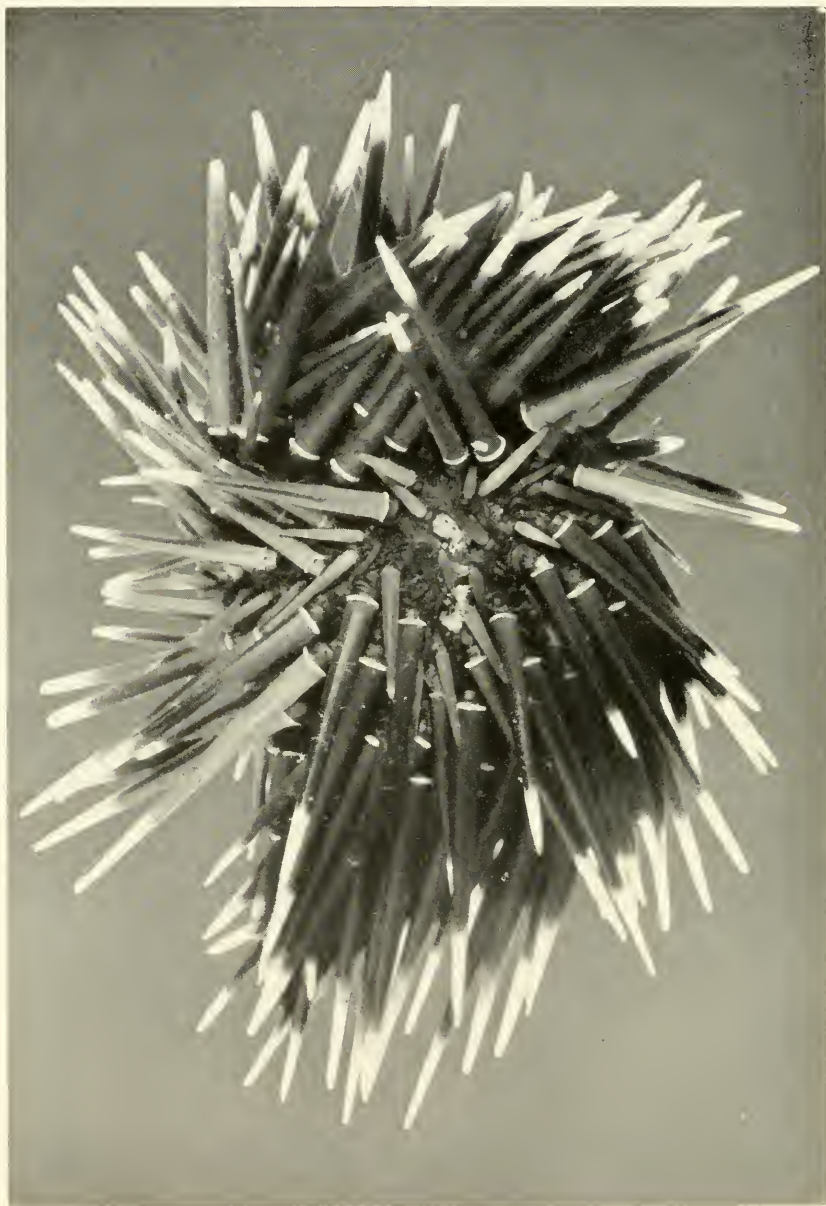
Parasalenia gratiosa A. Agassiz, aboral surface, $\times 2$.



Parasalenia grotiosa A. Agassiz, oral surface, $\times 2$.



Echinometra mathaei (de Blainville), oral surface, $\times 2$.



Echinometra mathaei (de Blainville), aboral surface, $\times 2$.

The tridentate pedicellariae are quite numerous and are of two types, the large ones being very elongate, slender, with the head 1.5 to 1.7 mm. long, the valves meeting on the distal half of their margins. The small, tridentate pedicellariae are formed of leaf-like blades. A few globiferous pedicellariae are present, mostly located on the actinal area. These contain many bihamate spicules.

REFERENCES: *Parasalenia gratiosa*, AGASSIZ, A., Bull. Mus. Comp. Zool., vol. I, 1863, p. 22; Mem. Mus. Comp. Zool., vol. VII, pt. III, pl. 3d, figs. 1 and 2.—DE MEIJERE, J. C. H., "Siboga"-Expeditie, Echinoidea Monogr. 53, Livr. 14, 1904, p. 97 (extensive reference list).—MORTENSEN, TH., K. Danske Vidensk. Selsk. Skrifter Nat. og Math., 7 E R I, 1906, p. 121, pl. 5, fig. 36.—CLARK, H. L., Mem. Mus. Comp. Zool., vol. XXXIV, 1912, p. 369; Publ. 214, Carnegie Inst. Wash., Dept. Mar. Biol. Papers, 1921, p. 150; Catalog Recent Sea-Urchins B. M. N. H., 1925, p. 141.

Genus: ECHINOMETRA Rondel 1554

Echinometra mathaei de Blainville

Plates 93 and 94

TYPE: De Blainville's type, which is in the Paris Museum, came from the Indian Ocean.

DISTRIBUTION: This small sea-chestnut is gregarious and abundant in the reef-dwelling fauna of the vast Indo-Pacific region. It has been reliably reported from the Gulf of Suez, Egypt and the Red Sea, eastward through the Persian Gulf, the Indian Ocean, north to Japan, and southward to the east African coast, and eastward in the Philippines, New Guinea, Australia, Polynesia, the Society Islands and the Hawaiian Islands.

MATERIAL EXAMINED: Ten specimens from Venus Point Reef, Tahiti, Society Islands, August 15, 1931. Four small specimens, in coral, Teviatea Reef, Raiatea Island, Society Islands, August 21, 1931.

TECHNICAL DESCRIPTION: The test of *E. mathaei* is thick, with the height usually between 55 and 65 per centum of the length; the abactinal system is from 15 to 25 per centum of the length, and the width of the test is from 65 to 75 per centum of the length.

The "Alva" specimens measure (in millimeters) :

Height	Width	Length	Height	Width	Length
6	8	10	18	23	33
3	5	6	18	13	20
2	3	4	16	22	28
19	25	32	8	13	17
17	13	21	9	12	16
18	21	25	6	7	10
15	24	31	4	6	7

The pore pairs at and above the ambitus are arranged in arcs of four, and in some specimens in arcs of five. The genital plates each average four to six secondary tubercles. The primary spines are rather short, their length averaging 0.4 to 0.5 of the width of the test. In colour these spines are quite variable. Of the seven larger Tahitian specimens (alcohol preserved), four specimens have the proximal 0.5 to 0.6 of the primaries deep brownish-purplish, with the remaining distal portion creamy white; two other large specimens have the primaries faded deep greenish proximally and distally, are pinkish-lavender-creamy, while another specimen has the primaries entirely cream colour but with a faded lavender tinge proximally. The test of all these specimens is brown or purplish-brown.

REFERENCES: *Echinus mathaei*, DE BLAINVILLE, H. M., Dict. Sci. Nat., t. XXXVII, 1825, p. 94.

Echinometra mathaei, DE BLAINVILLE, H. M., op. cit., t. XXXL, 1830, p. 206.—CLARK, H. L., Pub. 214, Carnegie Inst. Washington, Dept. Marine Biol. Papers, 1921, p. 151; Catal. Recent Sea-urchins, B. M. N. H., 1925, p. 143.

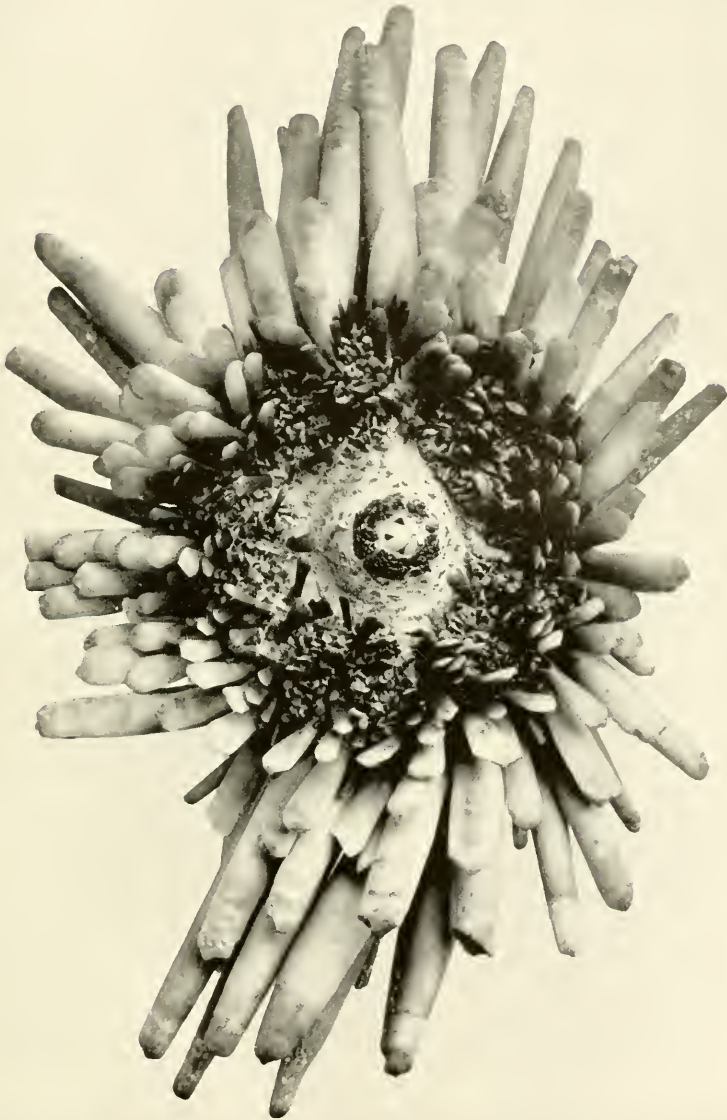
Echinometra lucunter, AGASSIZ, A., Mem. Mus. Comp. Zool., vol. VIII, pt. III, 1873, pl. 4-b, fig. 4.

Genus: **HETEROCENTROTUS** Brandt

Heterocentrotus trigonarius (Lamarck)

Plates 95 and 96

TYPE: Lamarck's type specimen was without reliable locality, his citation being "*Habite . . . la Mediterranee? Mon cabinet.*" This was later deposited in the Paris Museum.



Heterocentrotus trigonarius (Lamarek), oral view,
about one-half of natural size.



Heterocentrotus trigonarius (Lamarck), aboral view,
about one-half of natural size.

DISTRIBUTION: This species is widely distributed in the southern Indo-Pacific from eastern South Africa to the Paumotu Archipelago. It is recorded from the Zanzibar coast, Indian Ocean, Mauritius, Philippine Islands, New Guinea, Caroline Islands, Gilbert Islands, Marshall Islands, Fiji Archipelago, Baker's Island, Tongatabu, Society Islands, and Paumotu. It is restricted to the littoral zone.

MATERIAL EXAMINED: One very large specimen from Muller's Reef, Bora-Bora, Society Islands, August 25, 1931. Four small to medium-sized specimens from Venus Point Reef, Society Islands, August 9, 1931.

COLOUR: This species shows considerable diversity of colour, according to the records. Some are reported to have brown test and spines with shadings of green and orange-red on the primaries. Others from the Society and Paumotu Islands are deep purple, or of varying shades of purple. Some of the "Alva" specimens, from the Society Islands, are deep purple, while others are brownish with a greenish cast; these latter are apparently more faded by the alcohol than the royal purple specimens, some of which retain the deep purple streaked with brownish where the purple has very obviously faded.

DISCUSSION: This genus of well-known "slate-pencil" urchins has but two valid species, *H. mamillatus*, the genotype, which is more northern in its distribution, and the present species, *H. trigonarius* Brandt, which possesses an even greater individual diversity in several characters than does the genotype. The most reliable diagnostic feature of *H. trigonarius* is to be found in the fact that the pore-pairs in mid-zone, are in arcs of eleven (ten to twelve), while those of *H. mamillatus* in mid-zone are in arcs of fifteen (variation fourteen to nineteen). The secondary spines of *trigonarius* are short, normally pointed and tapering, while in *mamillatus* these are usually stout and bluntly truncated. The secondaries of *trigonarius* show more diversity, occasionally being as stout and truncate distally as those of *mamillatus*. As shown in the plates 95 and 96, the primary spines of *trigonarius* vary from long, thick, trigonal with tapering and subacute apices to short, clavate, distally, truncate ones. *H. trigonarius* has normal primary tubercles in the abactinal region, while *mamillatus* has none here.

Also, as reported by Dr. Mortensen, the tridentate pedicellariae of the two species are different, those of *trigonarius* being composed of bluntly pointed valves, which are in contact along the greater portion of their lateral and apical margins.

REFERENCES: *Echinus trigonarius*, LAMARCK, J. B., Hist. Anim. sans Vert., t. III, 1816, p. 51.

Heterocentrotus trigonarius, BRANDT, Prodom. descript. Anim., 1835, p. 266 (66).—AGASSIZ, A., Mem. Mus. Comp. Zool., vol. VII, 1873, p. 133, 430, pl. 3d, fig. 6.—DE MEIJERE, J. C. H., "Siboga"-Expeditie, Echinoidea, Livr. 14, Monogr. 53, 1904, p. 102 (with extensive bibliography).—MORTENSEN, TH., "Ingolf" Echinoidea, I, 1903, p. 129.—CLARK, H. L., Mem. Mus. Comp. Zool., vol. XXXIV, 1912, p. 379, pls. 118-120.

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